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Highway Engineers by Brevet

THIRTY-ONE deputy highway engineers, and only two of them trained in the technicalities of road building! This, according to press accounts, is the personnel of the organization in charge of county highways in a state of the Middle West. The newly appointed officials, we are informed, "are farmers, clerks and janitors," but it should be noted that "several have had experience with machinery." The one ray of hope which this statement appears to offer is obscured by its failure to be specific. What kind of "machinery"? There are all sorts—political as well as road-building. Still, why shouldn't a sober, intelligent janitor make a good deputy county highway engineer? Why shouldn't he be elevated by brevet, as it were, from cellar to street level? There is precedent for such action—in the Gilbert and Sullivan opera "Pinafore," for example. The "office boy in an attorney's firm" rose to be "ruler of the Queen's navee"—and all because he knew how to "polish up the handle of the big front door." If admirals can be developed from polishers of front-door handles, why cannot janitors blossom out into county highway engineers? The answer, of course, is that they can. The main point, however, is that the admirals, as characters in opera, spend only stage money. Janitor-highway engineers, on the other hand, handle hard cash.

Quartz-Gravel Concrete and Fires

A SERIOUS question is raised by Ira H. Woolson, consulting engineer to the committee on construction of buildings of the National Board of Fire Underwriters, in his exhaustive investigation and report of the results of the fire in a warehouse at Far Rockaway, N. Y., abstracted on page 98 of last week's issue of the Engineering Record. Is pure quartz-gravel aggregate unsafe in concrete used for fire-resistive purposes? The evidence presented by Mr. Woolson throws a strong suspicion upon this kind of aggregate. When such structural damage, which, in comparison with the temperatures attained, is relatively much greater than that in the memorable Edison fire of 1914, occurs in a so-called fireproof building subjected to flash fires of short duration, it is essential to the future of this type of structure to demonstrate the cause and avoid its recurrence. Even granting that part of the observed failure in the case here reported may have been due to insufficient concrete protection for the reinforcing steel, the other investigations cited by Mr. Woolson, showing the effect of heat on quartz-gravel concrete, reported as long ago as 1907 and apparently never disproved, and the cases of beam failures observed in this fire where concrete thickness was ample, make the occurrence a most notable one. It should result in exhaustive investigation, as this matter has important economic significance, especially in the vicinity of New York City.

Protection of Primary Natural Resources

THE member organizations of the Chamber of Commerce of the United States have, by a large majority, approved of the proposal that business interests be permitted to make co-operative agreements under federal supervision in those industries which involve primary natural resources, on condition that the agreements in fact tend to conserve the resources, to lessen accidents and to promote the public interests. The vote stood 1034 in favor of the project and 110 against. It has been shown that competitive conditions in mining and lumbering particularly tend to a wasteful policy of removing these resources and to the use of methods which often endanger life. If the producers, however, were allowed to enter into agreements which would permit a pooling of interests, a distribution of territory, and a limitation of production in certain sections to fit market conditions, the wasteful conditions could be entirely eliminated or very greatly minimized. The permission to co-operate, however, would only extend to the resources of a primary character and would not disturb the application of the Sherman Law to finished or fabricated material. The vote is in accord with sound thought on the conservation of natural resources and with the practice in foreign countries. Should Congress hearken to the voice of the business men of the nation, the Federal Trade Commission would be empowered to permit the execution of co-operative agreements in the fields suggested. Unfortunately, Congress seems to be panic-stricken on the matter of combinations and trusts and it will need much educational work to persuade its members that the proposed measure can be put into effect without detriment to the public interests.

Are Engineers Professional Men?

THERE is food for thought in the extract from an address by Prof. F. H. Newell printed on page 146 of this issue. He gives a clear-cut definition of that which stamps one as a "professional man" and from his definition justifies some of the activities of engineering societies which the conservatives have criticized. The distinctive feature of the professional man, Professor Newell says, is that he "does not work under the immediate direction of some other person, nor does he perform certain set operations within certain hours. He is called in not to carry out instructions of an employer but, on the contrary, to dictate to the man who ultimately pays the fee when, where and how certain things must be done. He ceases to be a professional man the moment he takes orders from an employer."

This definition being accepted, and few will dispute it as being the strict definition of that which constitutes a professional man, it is apparent that our engineering societies are composed most largely of men who are not yet in the professional category, but are headed in that direction. The leading engineering societies, when first established, aimed to serve only the truly professional element in their membership by building up an organization with high prestige. They emphasized the high plane of the calling of their members. When searching analysis, however, is made of the needs of the non-professional element of the membership, there is ample justification for those activities which are essentially of the type of "service." These have not found favor with the larger organizations, but have been made much of, and very properly so, by the smaller societies.

In our judgment, Professor Newell is thinking straight in his deductions from his definition. His words should stimulate discussion and the discussion, we hope, will result in strengthening the "service" activities of even the most elevated of the national engineering organizations.

Action on Water Problems

REALIZATION of the uses to which hydroelectric energy can be applied has increased at a record rate during the abnormal conditions of the last two years, but meanwhile there has been no change in the control of water rights which would encourage a degree of development comparable to the broadening field. Hope still clings to the prospect of federal legislation that will improve the present situation, but while that action is deferred there are phases of the water problem which the individual state legislatures can clear up. California realized this and appointed a carefully chosen committee to make an investigation and to report on action which the state Legislature of 1917 might profitably take. Heretofore if there has been any state policy at all it has been one of "intensive restriction." Therefore it is a most encouraging sign to find in the report of this committee, prepared after more than a year's investigation, recommendations for action along lines calculated to encourage development.

The report is abstracted at some length elsewhere in this issue because there should be in other states as well as in California a keen interest in the purpose and results of this study. The committee wisely states that a perfect organization cannot be built in one year nor by one legislature and that to attempt too much is frequently to lose all. Nevertheless there has been no hesitancy in recommending radical changes where it has seemed that the possible danger in such a move would be less than a continuation under the present disadvantages.

Some opposition has appeared, even within the conference itself, as is indicated by a partially dissenting minority report. The personnel of the committee, chiefly state office holders, did not include any representatives of power companies or other interests directly concerned, though of course the power companies, irrigationists and all others interested were given a hearing. However, very fair consideration seems to have been accorded all interests involved, and on the whole the report has been received with much favor. Organizations with interests at stake now have authoritative facts and figures to back up their demands upon the legislature for action. No matter in which direction they tend, the interests which are hoping and working for a larger development of water resources will welcome effort directed toward getting at the real facts of the situation and recommending at least a definite policy and purpose in the control and development of water powers. Once under way in the right direction, the course can be shaped more exactly. Almost anything would be better than passively ignoring changing conditions and the opportunities that attend them.

Where Original Cost Was Found

ORIGINAL cost is reported by the Interstate Commerce Commission in its tentative valuation of the Winston-Salem Southbound Railway. The road is a small one, with only 90 miles of line, and was opened for traffic only six years ago. Hence the original records were largely available. Furthermore, that the embarrassing complications that may arise in older properties from renewals differing from the original construction were not considered applicable is evidenced by the statement that "the amounts may not in every instance represent the exact cost of property units now in place, as some renewals doubtless have been made." This is probably a conservative assumption as far as crossties, at least, are concerned.

As the commission still declines to give the reproduction cost of land, no comparison can be made between its total original cost and its reproduction cost. Exclusive of land, however, the original cost of the road to date is found to be a trifle more than the cost of reproduction new, the respective figures being $5,153,996 and $5,121,188. In view of the constantly increasing prices of materials and labor, this is rather surprising, even though, because the valuation was made as of June 30, 1915, the extreme prices of the last 18 months would not figure. Although the commission allows the company slightly more for bridges, trestles and culverts, and considerably more for ballast than the book costs, it allows less for grading, ties and rails, and cuts nearly in half the original-cost figures for track-laying and surfacing, crossings and signs, and signals and interlocking. For equipment it allows practically the identical original-cost figures.

For general expenditures it allows an increase of 50 per cent.

With depreciation of $368,182 deducted, the reproduction cost of road and equipment is $400,000 less than the original cost. In the matter of land, the commission is unable to separate the carrier land from the non-carrier land in original cost, but the present value of all land is given as $135,000 more than its original cost. Thus what the state commissions might consider the proper reproduction-cost figure for the whole property is about $265,000 less than the original-cost figure. If these amounts are ultimately sustained, it will be interesting to see whether the state commissions argue for original cost as vigorously in this particular case as they usually do.

An Unbalanced Report

ANYONE who has followed the brick-paving art in this country will read with disappointment the report of the committee on road materials of the American Society of Civil Engineers, presented last week. It shows a lack of contact with the best thought in brick-road construction. While there are a number of minor delinquencies, space will not permit their discussion here.

Suffice it to point out that the committee devotes but two sentences to the modern monolithic type of construction and there casts suspicion on the type because it is "less capable of absorbing shock" than roads where bituminous filler and sand foundations are used. In other words, the new type—so heartily approved by those who are competent to speak on brick-road construction—is accorded a mere mention, coupled with a turn of thought that gives preference to a construction which the best thinkers in the brick-road field regard as obsolete. Furthermore, the report gives equal weight to a bituminous cushion. This is purely experimental and has no standing with brick-pavement constructors. Then, too, the entire chapter on the cushion course deals with resiliency, whereas the whole tendency in brick-pavement work is toward monolithic construction.

Another indication of a lack of sympathy with the best thought in brick-pavement construction is the very brief reference, in connection with a discussion of the bituminous filler, to the lower cost of making street openings where the bituminous type of filler is used. Brick-road builders aim to get the best construction from the standpoint of the traffic which the street is to carry, knowing that the area of cuts is small compared with the total paved area. Those who argue for bituminous fillers on the basis of lower cost in making street openings are arguing on accidentals and neglecting the essentials.

The report, with reference to the brick pavement section, is a reflection not so much upon the committee, for the members have undoubtedly given of the best of their experience, but upon the society which allows an unbalanced committee on so important a subject to continue year after year. There are on the committee men who are widely known for their experience in asphalt, stone-block and wood-block construction. We fail to recognize any men in the group of seven, however, who are conspicuous as authorities on brick roadways or even on concrete construction. The committee is badly in need of reorganization.

Americanization

THE WORD "Americanization" has come within the last two years to have a very definite significance. It means the transformation of the immigrant into an American, first, by teaching him English, and then by educating him up to American standards and instilling in him a love for American institutions. Only those who have dealt much with the immigrant know what a task this is, and also how great is the reward for any intelligent effort put forth. Only recently has the full significance of the problem been realized.

The instrumentalities through which Americanization is to be brought about are many. Fundamentally, they are of an educational character, but conditions within industrial plants, and particularly the character of management, exercise a large influence on the progress which the immigrant makes. Furthermore, if Americanization is taken in its broad sense, it applies not only to the immigrant, but also to the American-born worker, for thousands of them are not Americans at heart, and do not appreciate the conditions under which they live. Their self-respect, their outlook is raised by educational effort in their behalf, by fair treatment on the part of the management, by sanitary and cheerful surroundings, by proper care after injury, and support of their dependents under reasonable conditions in case of death resulting through their occupations.

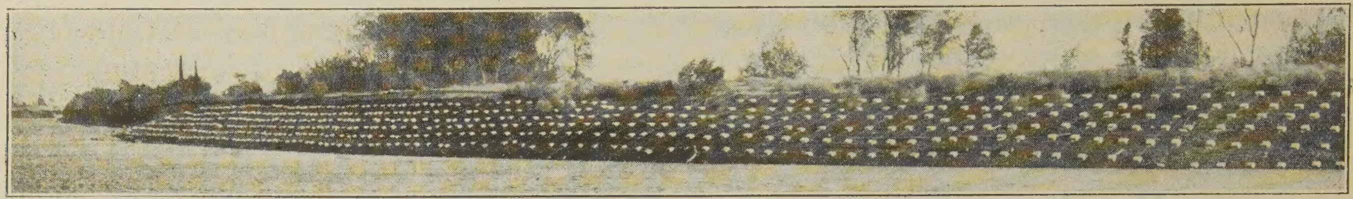
Not only are these some of the elements that affect the productive capacity of a plant, but each, in order that it may be kept in its proper place and that the industry may profit to the utmost from it, needs careful scientific analysis, and this only the engineer, of all the men engaged in industry, is capable of giving. It is for that reason that Americanization and "industrial Americanization," a term recently coined, have special significance for the engineer.

This relationship of the engineer to Americanization was brought out at a dinner given by the Immigration Committee of the Chamber of Commerce of the United States of America on Friday of last week. Dr. Ira N. Hollis, president of the American Society of Mechanical Engineers, speaking at the meeting, pledged the support of engineers in any plans that the chamber or its immigration committee might make. Far-seeing engineers fully appreciate their responsibility and opportunity in this movement, but it is hoped that either a group of the engineers who attended the immigration committee's meeting or the committee itself will take the initiative in placing clearly before all the engineers of the nation the part they can play in the Americanization of our industry.

Types of Bank Protection on the Sacramento River Compared

Costs Given for Methods Suited to Various Stream Conditions and Land Values —No Scheme Wholly Satisfactory, But Weighted Brush Mattresses Preferred

By NATHAN A. BOWERS
Pacific Coast Editor, Engineering Record



WILLOW-BRUSH MATTRESSES WEIGHTED WITH CONCRETE MOST COMMON ON SACRAMENTO RIVER

SEVERAL types of bank protection are found on the Sacramento River, depending on stream conditions and land values. None applied to date have proved wholly satisfactory, considering both their cost and their effectiveness. Weighted brush mattresses, however, costing about $10 per linear foot, seem to be the most popular. The purpose of this article is to compare the different forms of protection that have been used, together with the conditions that have determined the forms.

THE SACRAMENTO RIVER

The Sacramento River drains the entire central valley of northern California and carries to the sea the melted snows of the Sierra Nevada and Coast ranges which border the valley on either side. Governed largely by weather conditions in the higher altitudes, its flow ranges from a normal minimum of about 5500 sec.-ft. during the late fall to the flood of 559,000 sec.-ft. which occurred in March, 1907.

The grade in the channel averages about 2.5 ft. per mile in the 50 miles between Red Bluff and Chico Landing, while below Sacramento it varies from about 0.1 ft. per mile at low water to about 0.5 ft. per mile at high water. The total fall is less than 300 ft. in the 250-mile stretch between Red Bluff and the mouth. The bottom land on either side is fertile and valuable, but large areas in the lower part of the valley are below high-water level, and their value depends on the use of levees. The tops of many of these levees are 25 ft. above adjacent lowlands, the farmers living upon the lands cultivated.

MUCH LAND TO BE RECLAIMED

Much more lowland will be reclaimed upon the completion of the "Bypass" project, which will provide a separate channel or short cut to the mouth for carrying off all flow above a certain amount. Meanwhile, extensive diking is necessary, and as sand is usually the only material available the dikes require protection on the river slope wherever there is a strong wave or current action. Since the river height varies as much as 30 ft. in some places where slope protection is required, this work can be very costly unless some simple form of construction is adopted. On reclamation districts 1000 and 1001 there are 96 miles of levees, ranging in height from 9 to 25 ft., the average along the river being about 15 ft. Slopes of 2:1 and occasionally even steeper slopes are used, but the best practice requires a slope of 3:1 on the river side.

VARIETY OF USES OF LAND

Unlike the Colorado or the Mississippi, the Sacramento River traverses, within a few score miles, territory suited to a wide variety of uses, its needs ranging from no irrigation at all to extensive irrigation requirements. The value of the land, and likewise the funds which it is feasible to spend for dikes and dike protection, also vary between wide limits, so that on the Sacramento River the desideratum may be simply the most effective bank protection, or it may be the best bank protection that can be built within the limits of a specified amount per foot. Another point of difference from larger streams is that the shorter duration of the flood period decreases the danger from dikes long subjected to saturation.

Because of the increased economy of diking when large areas are involved, there has been popular approval of a combination of interests of flood-protection work. This has been facilitated by the activities of the State Reclamation Board and the California Débris

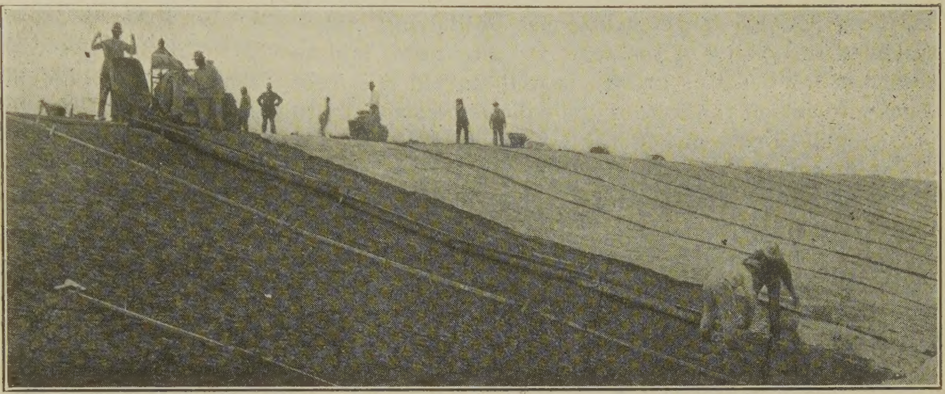
SERIES OF DEFLECTORS IN RECLAMATION DISTRICT 1000 DESIGNED TO CAUSE SILT DEPOSITS ALONG BANK DOWNSTREAM

Commission, and in future work there is no excuse for not taking every advantage of all that has been learned in the new designs thus far tried out. Slightly under 300,000 acres are now under dike protection in the Sacramento Valley. Land subjected to floods held at $10 to $20 per acre often becomes worth $200 to $300 per acre after the dikes are in service.

WEIGHTED BRUSH REVETMENT

After some experiment with flexible mattresses made of brush fascines and cables, the State Engineering Department developed a plan which has been used with slight modifications for many years, and more revetment of this type than of any other has been built. It consists of a mattress built of fascines of willow brush from 8 to 12 in. in diameter and about 20 ft. long, which are laid double, with broken joints, and woven together with cables spaced about 8 ft. apart.

Before the mattress is started a line of concrete anchors is placed on top of the levee and connected up by a ¾-in. cable. If the material on the levee is very firm, patent screw anchors such as are used in telephone pole-line construction are used in place of concrete deadmen. At 8-ft. intervals ¾-in. cables are attached to this anchor line and laid down the slope of the embankment to barges floating in the stream. On top of these cables the fascines are placed and woven together.



PLACING A 3-INCH PAVING ON WELL-COMPACTED LEVEE—SUCCESSFUL PAVING OF THIS TYPE IS FOUND IN DISTRICT 307, 15 MILES SOUTH OF SACRAMENTO — REINFORCED WITH WIRE MESH, IT HAS BEEN IN SERVICE SIX YEARS

CONCRETE BLOCKS FOR SINKERS

After the weaving is finished another series of ¾-in. cables is placed on top and immediately above the supporting ¾-in. cables, and the cables above are lashed to those below at 6-ft. intervals. The cable placed on top terminates at the upper edge of the mattress, where it is clamped to the cable beneath. At the lower edge of the mattress both cables terminate in concrete blocks about 2½ ft. square and 12 in. thick, cast on the barge. These blocks serve as sinkers. Rows of concrete blocks spaced from 6 to 10 ft. apart are cast in place on the brush mattress as weights to hold it down. The size of the latter is varied with the buoyancy of the brush and force of the current, but is usually about 3 ft. square and 6 in. thick. A turn, or knot, of the cable on which they are cast is embedded in the form before the concrete is set. These weights are placed in transverse rows, and the rows are tied together longitudinally by cables running along both upper and lower selvedges.

Above the water line the mattress is woven on the ground, which has first been prepared by grading to a uniform slope. When the water's edge is reached the weaving continues on the cables, which are supported over the water by planks; the barge is held off shore by spars or struts, together with shore lines, and when the desired mattress width has been completed and the concrete blocks are ready, the barge is shoved away, permitting the structure to sink. This mattress, being flexible, will continue in service even if the current cuts away the slope beneath it, because the weights drop down and the mattress adjusts itself to any slope.

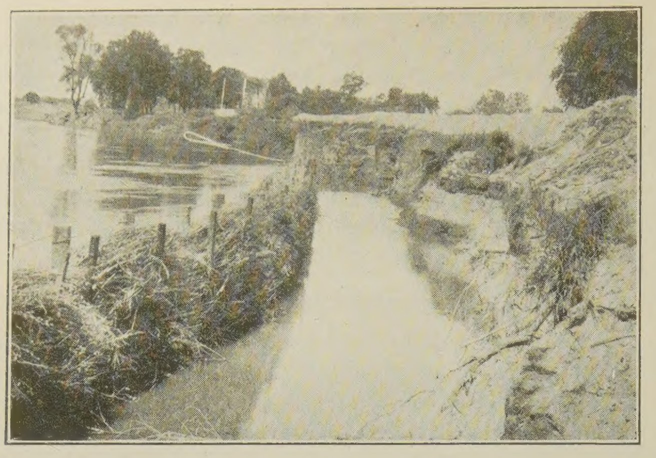
GRANITE BLOCKS INSTEAD OF CONCRETE

Granite blocks have been substituted for the concrete weights in some of this work, at a considerable saving in cost. Granite blocks ranging up to 200 lb. in weight have been used at a cost as low as 55 cents per block. These blocks are drilled and the cable is riven through the holes. Where concrete blocks have been cast on the mats it has not been found worth while to use forms over again, so new forms were built for each block. On a small job the form cost has amounted to about $3.47 per cubic yard, where the total concrete cost has been about $16 per cubic yard. The cost of these concrete blocks ranges from $10 to $16 per cubic yard and is influenced largely by the size of the blocks and the delivery charges on materials.

The total cost of the brush revetment when weighted with concrete is usually from 9 to 11 cents per square foot. This varies with the size of job and nearness of construction materials. The amount of grading required on the levee slopes may increase the cost considerably, but under normal conditions and for a slope width of about 70 ft. the cost has been found to range from $6 to $10 per linear foot. Where fascines have been held in place by stakes, and no weights used, costs have been as low as $1 to $3 per linear foot.

MATTRESSES THICKENED ALONG TIDAL ZONE

Mattresses made of fascines are often thickened along the tidal zone to forestall the slipping or washing down of sand that sifts into and through the brush. On clay or alluvial soil this precaution is unnecessary. In some instances mattresses of this type have been floated into place and suspended as a temporary measure, particularly above broken masonry structures or in repairing breaks. At best, however, this brush protection is considered a semi-temporary measure. It is usual for the state to assess half the cost of the work on adjacent land-owners and allow half to be borne by the state. Where the brush mattresses are alternately wet and dry they decay rapidly.



GOOD PROTECTION FROM STEAMER WASH IN SHALLOW WATER, BUT SUBJECTED TO SERIOUS DAMAGE WHEN STRUCK BY BOATS

At most points along the lower Sacramento it is difficult to start a brush growth much above the water level because of the hot-weather effect in drying out the sand embankments, but where there is sufficient moisture it has been possible to get a live mat by driving willow stakes in the spring of the year into a mattress laid as described. When this growth is well started it is customary to cut off the tops of the willows occasionally to prevent tall growth and induce a thick spread.

Fascines placed at right angles to the river were used to protect a mile of levee on a 2:1 slope in district 1001, where a very swift current had caused serious undermining. The fascines were placed in four tiers, the lowest of which extended below low-water line, where it was anchored with concrete blocks. The four tiers protected a slope width of 70 ft., were securely interlaced with ¾ to 1¼-in. steel cables, and were fastened to concrete deadmen and patent screw anchors at the top. Owing to the fact that the cables were bought second-hand practically at junk prices the cost of this work was only 3.8 cents per square foot, or $2.65 per linear foot.

PILING WITH FASCINE FILLING

Bank protection consisting of a single line of piling with a backing of fascines has been used in various forms on the Sacramento River. The piles are usually driven 15 ft. into the river bottom, spaced 10 ft. apart. One or two feet on the inshore side a 4 x 4-in. redwood post is driven a foot or two into the river bottom and cut off with its top on a level with the top of the pile. Between the 4 x 4 and the piles a filling of fascines in single thickness is placed and wired to the piles.

This protection is not generally used where the depth is more than 10 or 15 ft. at low water, but it is considered an effective protection from the wash of steamers at low stages of the river. It has been used extensively below Sacramento, where the bank caving is due chiefly to the waves caused by the frequently passing vessels. It is, however, subject to serious damage when struck by boats or barges in tow, which break off the piles. Also, where bank caving is caused by current erosion during flood stages and by seepage water returning into the river after it has fallen rapidly, this type of protection is not the most effective.

The cost of this work in place ranges from $2.75 to $3.50 per linear foot. During the last four years Haviland & Tibbetts, civil engineers, have installed for West Sacramento about 1½ miles of this type of bank protection, the original design of which was developed by P. N. Ashley of Woodland, Cal. The average cost of this work was $2.75 per linear foot. A length of about a mile of similar revetment was built for two reclamation districts above Sacramento at an average cost of $3.50 per linear foot.

FASCINE FILLING TO REPAIR LEVEE BREAKS

Piling with fascine filling is often used on the Sacramento River for repairing breaks in levees. An example of this is the work on Sherman Island, where four rows of piles were driven across the break along the line of the old levee. The two inner rows of piling were 20 ft. apart and the two outer rows 26 ft. apart. The outer rows were staggered and fascines were crowded down in the 3-ft. space between them. When the current had been very largely reduced by this means hydraulic sluicing methods were used to fill the 20-ft. core between the two fascine facings.

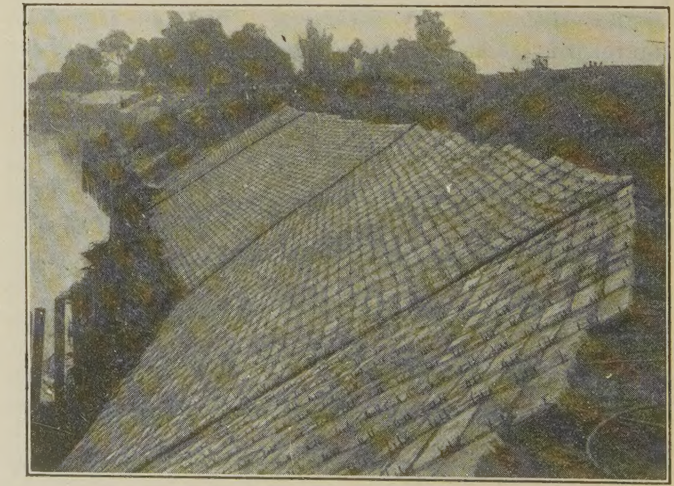
This work was carried out where the depth was from 25 to 30 ft. and the tidal currents very strong. It is noteworthy that it was necessary to brace the piles transversely to prevent vibration and "popping out."

When bids were first called for on this work the lowest offer was $43,000, but the plan just described proved effective and the work was completed within two months at a cost of about $18,000.

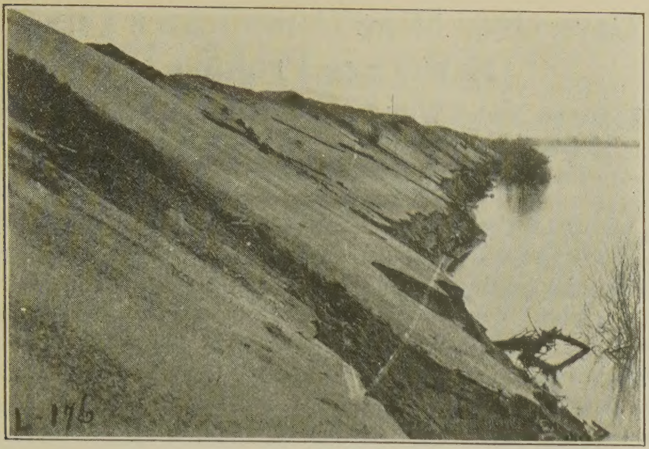
WEDGE-SHAPED DEFLECTORS

A type of bank protection known as the Dean deflector has been used at various points along the river. On reclamation district 1001 this type of structure was built to safeguard about two miles of embankment. As first constructed the structure did not withstand the flood stages, but a similar type built according to a much improved design is asserted to have withstood the high water of 1915-16 and to have satisfactorily built up sand deposits along the bank below.

The deflectors are used to deflect strong cross-currents, and are made wedge-shaped with a nose angle of about 35 deg. The frame is built up of 6 x 8-in. timbers, firmly cross-braced and sheathed with 2 x 6-in. facing. The nose is weighted down with a block of concrete containing about 2 cu. yd., hung on cables from



FLEXIBLE CONCRETE MATTRESS BUILT OF PRECAST UNITS
A solid toe wall is an important feature of this type.



EFFECT OF WAVE ACTION ON UNPROTECTED LEVEE
Water level still 5 ft. above levee base. Note slope and height.

the apex of the nose. Tie cables run from the nose to the bank along both upstream and downstream faces.

In order to allow the current to continue under the nose, only every third or fourth supporting post is extended to the bottom. Thus the current is checked somewhat but is not turned abruptly, as would be the case with a pile jetty. Hardly any eddy is formed on the downstream side of the deflectors, but a slight upstream current tends to cause deposition here of material in suspension. The deflectors are anchored into the bank by firmly driving the vertical 2 x 6-in. supporting posts and filling in the space between with brush and sand. They are usually spaced about 150 or 200 ft. apart and cost about $350 apiece for single-deck structures, 14 ft. high at the nose and 60 ft. long on top.

SLOPES PAVED WITH CONCRETE

Some concrete paving has been used for slope protection where the cost of such work could be afforded. Typical of the successful construction of this type is the concrete paving about 15 miles south of Sacramento in district 307, on the back levee of the Lisbon district. On this work about 700,000 sq. ft. was paved. The slope was first trimmed to about 2:1 or 3:1 without any effort at careful grading, and was then rolled after being thoroughly watered. The roller was drawn up the slope by means of an electric crab operating from the top of the levee. Before the concrete was poured the surface was hard and rough, the latter quality being encouraged as a desirable element in a sloping concrete foundation.

About half way up the slope a triangular trench 5 in. deep, with its lower side perpendicular to the slope, was carried the entire length of the paving to serve as a lug to prevent slipping. There were no longitudinal expansion joints, because the paving was only about 60 ft. wide, but an expansion joint running up and down the slope was placed every 60 ft. This joint was formed by terminating one slab in a depressed shoulder, which afforded a support at slope level upon which the edge of the adjacent slab could rest and move freely, tar paper being used to prevent bond between the shoulder and the next slab, which was afterward poured upon it. Where the slabs abutted a ½-in. space was left between them. The bottom of the slope at tidewater level terminated in a row of 2-in. redwood sheet piling.

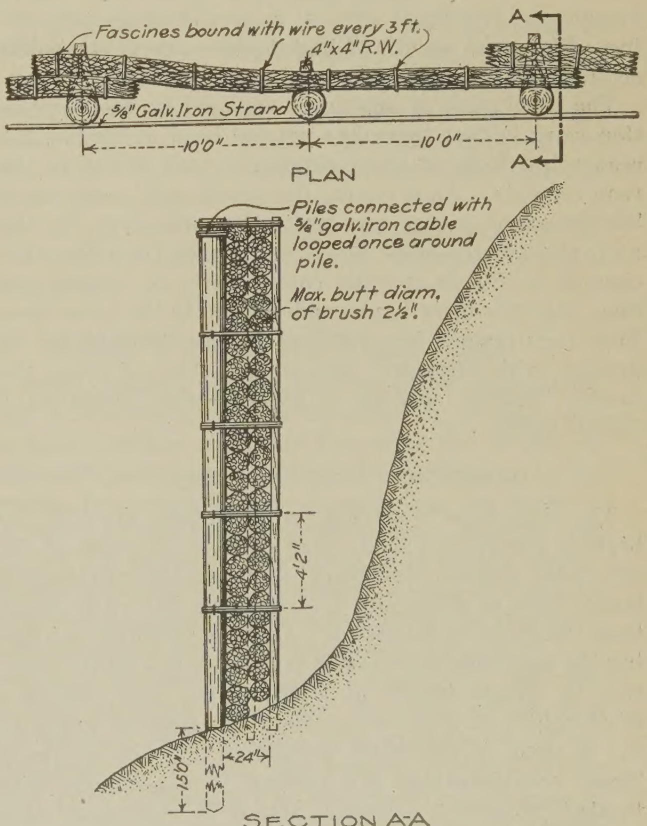
The paving is 4 in. thick, reinforced with 6 x 6-in. No. 10 wire mesh, the reinforcement being kept as near the center of the slab as possible. The finish was rough, no attempt being made to use the trowel. The cost of this work was about 12 cents per square foot, or $7.20 per linear foot, including grubbing and rolling. Since this paving was placed six years ago no movement or breakage has occurred, it is reported, although there were many breaks in the levee previous to that time. This work was designed and constructed under the supervision of P. N. Ashley.

It is significant that the dike referred to had been in service 8 or 10 years before the paving was laid. Paving built under similar specifications on a comparatively new levee failed during the first winter because of settlement in the foundation. The best practice is therefore to pave only well-settled embankments.

REINFORCED CONCRETE IN STRIPS

On the Yolo Basin side of the West Sacramento project reinforced-concrete levee facing was placed on a portion of the clay levees as a protection against waves during heavy storms. The concrete was laid in strips from 16 to 20 ft. wide and 3 to 5 in. thick, reinforced with light wire mesh. The maximum slope is about 2:1. In some of this work the toe terminates in sheet piles from 3 to 5 ft. long or in the concrete cutoff wall extending down into the berm. At the upper edge the slope rises up on the crown of the levee, but terminates in a parapet. The cost of this paving was about 12 cents per square foot.

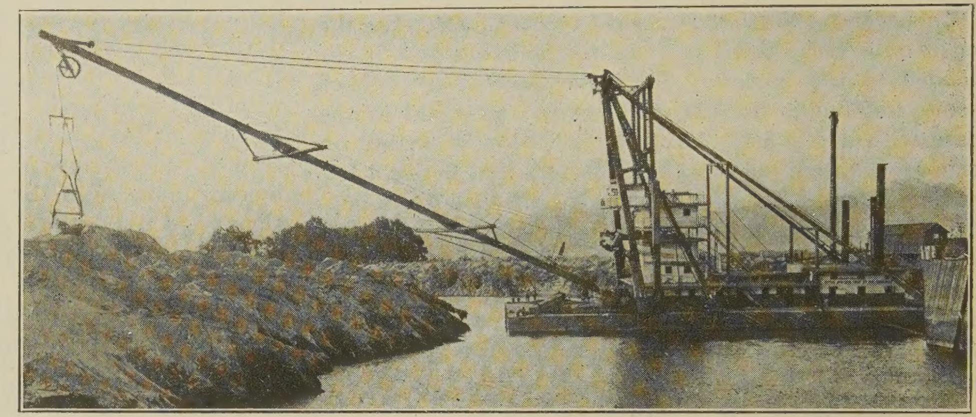
A type of articulated pavement consisting of precast concrete slabs small enough to be conveniently handled was used for protecting a stretch of the levee just below Sacramento. The slabs were cast with pairs of cable


Fascines bound with wire every 3 ft.
4"x4" R.W.
5/8" Galv. Iron Strand
10'0"
10'0"
A
A
PLAN
Piles connected with 5/8" galv. iron cable looped once around pile.
Max. butt diam. of brush 2½".
4'2"
24"
15'0"
SECTION A-A

BANK PROTECTION LIKE THIS COSTS FROM $2.75 TO $3.50 PER LINEAR FOOT tie wires extending from each corner, and these were used to tie the blocks to the anchor cables. This revetment requires a toe wall if not founded on a firm bank of flat gradient. In a length of about 1½ miles of this articulated revetment the cost, including about 1000 ft. of toe wall, was $10.62 per linear foot, or about 21 cents per square foot.

NARROW CHANNEL IMPORTANT ELEMENT

Embankment protection which can be considered fairly permanent, including the most substantial weighted brush mattresses, may be figured to cost, roughly, $10 per linear foot. This figure added to the original cost of dike or levee is more than is warranted by the value of the lowland to be protected except for short stretches where there is special danger, or where city property is involved. Because the channel is comparatively narrow at low water the steamer wash below the city of Sacramento, where the river traffic is heavy, becomes an important element in accelerating bank caving. The great weight of high levees close to the banks accentuates this difficulty.


DREDGE TYPE PRODUCED TO BUILD LEVEES WITHOUT REVETMENT — THIS MACHINE, THE "MARS," HAS A BOOM 230 FEET LONG AND OPERATES A GRAB BUCKET WITH A CAPACITY OF 6¼ CUBIC YARDS

The conclusion of engineers engaged in flood-protection work is that there has not yet been developed any economical type of levee revetment well suited to the requirements. As a result, the practice in many cases has been not to use any protection whatever for the river slope of the levee, but to set it back from the river channel as far as it could conveniently be located and then slope the river bank gradually up to the levee base. This requirement has resulted in the development of dredges with extremely long booms. One of these, the dredge "Mars," operates a 6¼-yd. grab bucket on a 230-ft. boom.

OBJECTIONS TO SETTING LEVEE BACK

The objections to setting the levee back are that the highest ground is usually very close to the bank of the low-water channel, and there is always the objection of landowners to giving up a strip along the river wider than the absolute minimum. Another difficulty in keeping the revetment cost low is that there is a 30-ft. variation in stream height at Sacramento. This means a 67-ft. width of slope even where the steepest grade of 2:1 is used, if full-width protection is to be provided. These considerations are leading to experiment with further revetment schemes, and it is still hoped that there will be developed a design which will afford the necessary degree of protection without prohibitive cost.

Cave Over Mine Complicates City's Sewerage Problem

Flume on Jacks Will Carry Storm and Mine Water —Disposal Plant Not Recommended, as Only a Clean Creek Bed Is Needed

SELDOM does a town of less than 10,000 inhabitants have the multiplicity of sewerage problems that confront the mining town of Iron Mountain, Mich. Caving ground over the Chapin mine across a valley down which the natural drainage formerly flowed and into which backed-up storm water now finds its way only to be repumped after seeping down 1400 ft. into the mine workings are the causes of much of the difficulty. Last October Alvord & Burdick made an exhaustive examination, and some of the more vital points are taken from their report.

In the first place the town is not growing and probably will not grow to any extent for a generation, because the timber industry has passed and the mining interests, while working at full capacity, are employing less men now than they did twenty years ago. Although spread out over an unusually extensive area, the present sewerage facilities were found adequate insofar as the sewers now reach the various parts of the city. Of four projects to carry away the sewage which originates in the main portion of the city up the valley from the cave, the cheapest was to bridge the 850 ft. of caving ground with a wood flume supported on jacks. The three other methods involved pumping over a hill or laying sewers in deep cuts across a saddle back of the town.

A 24-in. steel pipe now carrying domestic sewage, storm water and 5,000,000 gal. of mine water over the cave is to be retained for the domestic sewage only.

A shallow lake in the lower part of the town has been maintained under agreement at a constant level by diverting a portion of the diluted sewage flow. As the lake is used extensively for bathing purposes, the separate-system idea will permit only mine waste and storm flow to go to the lake, while the domestic sewage will continue down the valley to the outfall creek.

The withdrawal of the mine water from the 24-in. steel pipe may cause some trouble on account of freezing. If that is found to be the case it will be practicable during the winter to turn the warm mine water back into the steel pipe temporarily.

The relative advantages and disadvantages of separate versus combined sewers, as set forth in the report, are given below, for they are applicable generally. Among the conditions favorable to a separate system are these:

1. Where storm water does not require extensive underground removal, or where it can be concentrated in a few shallow underground channels.

2. Where drainage areas are short and steep, facilitating rapid flow of the water over street surfaces to the natural watercourses, but without erosion of the street surface.

3. Where the sanitary sewage must be pumped and the additional cost of pumping even a small amount of storm water is great. In this case especially is it true that if the overflow of storm water into a watercourse is not permissible, the separate system has great advantages.

4. Where the sanitary sewage must be purified and storm water in a combined sewer either purified or bypassed—either scheme requiring large purification plant capacity or creating nuisance due to the overflow of objectionable refuse.

5. Where the sewers are being built in advance of the city's development to encourage growth, the sanitary system provides a maximum of miles of sewers for a minimum of expenditure. The storm sewers, if ever required, may be built later, and rarely need cover over about one-half the area covered by a sanitary system.

6. Where an existing sewer is laid at grades unsuited to receive sanitary sewage, it may frequently be used as a storm sewer.

7. A combined system must usually be relatively of larger capacity than a separate storm drain for the same area, and the reason for this is that a storm drain may be overloaded at long intervals with slight inconvenience, whereas, on account of basement connections and the sewage carried by a combined sewer, any overflow is accompanied by great nuisance and complaint.

WHERE COMBINED SYSTEMS ARE DESIRABLE

The conditions favorable to the combined system are:

1. Where both storm-water sewers and sanitary sewers must be fully and completely installed throughut a district, the cost of complete storm drains and separate sewers in each street is greater than the cost of one combined sewer.

2. Where no pumping or purification of the sewage is required at present or anticipated for a reasonable length of time in the future.

The topography of Iron Mountain is such that the storm-water flow can be conducted underground through pipes following the original drainage lines, and therefore in shallow trenches. The slopes are so steep that main sewers only are needed for storm-water carriers if the separate system is used, while if combined sewers are used sewers of relatively large size will have to be laid in all streets where sanitary sewers are necessary. Great economies can be secured by the adoption of separate sewer systems for storm and sanitary flow, as well as a minimum of nuisance in the small outfall creek due to the frequent discharge of storm water in amount which exceeds the capacity of the outfall creek.

A comparison of four types of conduit across the cave included a 54-in. riveted steel pipe, a galvanized-iron flume, a 54-in. woodstave pipe and the 48 x 54-in. woodbox flume recommended. The table shows the result of the comparison—maintenance and repairs being assumed equal.

The useful life of the flume compared with that of the woodstave pipe was estimated longer because of the creosote treatment. The flume would be open at the top, and it would be banded with 4 x 4-in. timbers and rest on 4 x 10-in. timber stringers. The section would weigh about 175 lb. per foot. The bents would be placed 16 ft. apart and the 6 x 10-in. base plates would be supported by two 10-ton jacks, which would rest on a 6 x 12-in. mudsill.

COMPARATIVE TABLE OF FOUR TYPES OF CONDUIT

			ESTIMATED ANNUAL COSTS		
Type crossing	Estimated first cost	Life, years	Interest at 5 per cent	Replacement charge	Total
Steel pipe	$17,000	35	$850	$485	$1,335
Steel flume	2,750	15	137	183	320
Woodstave pipe	3.600	10	180	360	540
Wood flume box	2,000	20	100	100	200

OUTFALL NUISANCE EASILY REMEDIED

No disposal works were recommended for at least a generation. The dilution ratio of mine water alone to sewage is 1 to 10. Some time ago the city purchased a 100-ft. strip 2 miles long to the Menominee River on each side of the creek. This strip practically occupies the entire valley in which the creek lies. The storm water causes the nuisance because the cross-section, obstructed by vegetation, is insufficient. In consequence the water and sewage overflows the banks, depositing materials which later on give off odors.

Enlargement of the creek cross-section at a cost of $3,000, as against a $54,250 disposal plant, outright purchase of two adjoining farms or a $30,000 outfall sewer to the river is the proposed simple solution of the nuisance problem, with maintenance consisting only of the removal of the vegetable matter from the creek bed at least once a year.

The examinations were made on the ground for Alvord & Burdick by L. R. Howson, principal assistant engineer.

Alkali Brooms Poles and Posts

In alkali regions on the Uncompahgre reclamation project in Colorado a peculiar brooming of poles and posts takes place at the ground surface, due to the expansive action of alkali. The project manager in the December *Reclamation Record* states that the water is at or very near the ground surface where the brooming is noticed. A heavy coating of alkali is always visible. A telephone pole of Western cedar brooms to twice its natural size and so do fence posts of native cedar. A notable exception are posts of peeled cottonwood. An examination of the fence posts brought out the fact that cedar is more susceptible to alkali action than either pinon or cottonwood. The explanation is undoubtedly to be found in the relative porosity of the woods. It is evident that in the treatment of poles or timbers or porous wood exposed alternately to saturation and crystallization of alkali salts a waterproof coating is necessary.

Reinforced Concrete Successful for Railroad Culverts

Costs Less Than Cast Iron and Is More Durable in Acid Waters—Lengths, Types of Joints, Section and Reinforcement Discussed

By JOSEPH S. LAMBIE
Assistant Professor of Civil Engineering, University of Pittsburgh, Pittsburgh

FOR many years cast-iron pipe has been the favorite material for railroad culvert service. Though still used extensively by some of the more conservative roads, it is fast being replaced by reinforced concrete where materials for its manufacture are readily obtainable. This change is due principally to the considerably smaller cost of the latter type of construction, and in localities where sulphur or acid waters are prevalent to the non-corrosive qualities of the concrete.

BOX AND PIPE CULVERTS

Concrete culverts are of two distinct types—box culverts and pipe culverts. The former are constructed in place, usually according to designs prepared by the railroad, and are monolithic in character. The labor involved in their construction and the time necessary for their curing are features which make their use often undesirable. Pipe culverts are made in sectional lengths, varying in diameter from 12 in. to 8 ft. They may be made either on the ground at the point of erection or shipped, ready cured, from some central factory. Owing to better facilities for making and handling, the factory-made product is usually the better pipe. Some idea of the economy of the latter type of construction can be obtained from the accompanying table, which lists the various sizes, weights and prices of cast-iron and reinforced-concrete pipe.

TWO GRADES OF CONCRETE PIPE

Concrete pipe is made in two grades, the heavier being intended for service under track, while the lighter is used for longitudinal drains at grade crossings, or at any other point not directly beneath the track. No broad specifications have as yet been generally adopted leading to uniformity in the manufacture of this product, consequently considerable variation in the standards for length, type of joint, section and reinforcing of different manufacturers are noticeable.

Unit lengths on concrete pipe vary from 4 to 8 ft., as compared with 12 ft. for cast iron. It is claimed for the shorter lengths that they are easier to handle, will combine readily to form a culvert of any length, and are of particular advantage for maintenance work under a multiple-track roadbed, as they can be lowered between adjacent tracks without displacing the ties or interrupting the service.

Several types of joints are furnished by different manufacturers, with the common "bell and spigot" predominating. So-called "lock joints" are made with a variety of detail, the lock feature being obtained by the overlapping of the reinforcing for an inch or two at the joint, or by the filling of a groove in the joint with mortar. It is doubtful if these are of sufficient bonding or shearing strength to be very effective, and as this type of joint is usually of the "shiplap" character it is not of equal transverse strength with the body of the pipe.

The thickness of the shell and the shape of the section will vary with the amount and position of the reinforcing used. The illustration shows four general variations of these factors. The type shown in Fig. 1 is satisfactory for small sizes—12 to 18 in. in diameter—where the thickness of the shell is in excess of the thickness necessary to support the loads carried. The steel should be placed at the center of the shell. For pipe more than 18 in. in diameter, to obtain the greatest possible effectiveness of steel and concrete, two rings of reinforcing should be used—one placed near the inner and the other near the outer surface of the shell, as shown in Fig. 2. If it is possible to determine accurately the direction of the load thrust upon the pipe, a large economy of steel can be obtained by using only a single ring, as shown in Figs. 3 and 4. Since it is difficult to hold an elastic ring of steel in any shape other than a true circle, the latter of these two types is more commonly used—the steel being circular and the concrete section sufficiently elliptical in shape to produce the desired transfer of the reinforcing from the inside to the outside of the shell.

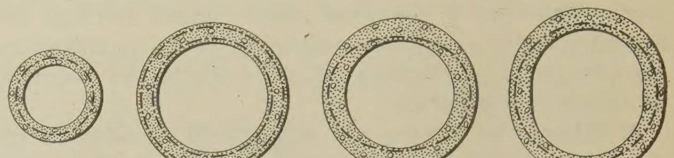


FIG.1 FIG.2 FIG.3 FIG.4

FOUR VARIATIONS IN CONCRETE-PIPE REINFORCEMENT

The position of the reinforcing, as shown in these latter figures, is correct for a theoretically vertical load. Any material variation of the line of thrust from the

COMPARISON OF COSTS OF STANDARD CAST-IRON AND REINFORCED-CONCRETE CULVERT PIPE

Inside Diameter, in.	CAST IRON								REINFORCED CONCRETE			
	CLASS A, LIGHT		CLASS B, MEDIUM		CLASS C, STANDARD		CLASS D, EXTRA HEAVY		HEAVY		LIGHT	
	Weight	Price	Weight	Price	Weight	Price	Weight	Price	Weight	Price	Weight	Price
12	72.5	$1.37	82.1	$1.56	91.7	$1.74	100.0	$1.90	105.0	$0.80	100.0	$0.70
*15	100.0	1.90	113.7	2.16	130.0	2.47	144.0	2.74	150.0	1.10	130.0	.90
18	129.2	2.45	150.0	2.85	175.0	3.31	191.7	3.64	200.0	1.40	150.0	1.10
24	204.2	3.87	233.3	4.43	279.2	5.31	306.7	5.83	265.0	1.90	235.0	1.50
30	291.7	5.52	333.3	6.33	400.0	7.60	450.0	8.55	370.0	2.60	300.0	1.90
36	391.7	7.43	454.2	8.61	545.8	10.37	625.0	11.88	500.0	3.25	380.0	2.45
42	512.5	9.74	591.7	11.22	716.7	13.61	825.0	15.67	650.0	4.00	475.0	3.05
48	666.7	12.67	750.0	14.25	908.3	17.25	1050.0	19.95	810.0	4.90	590.0	3.75
54	800.0	15.20	933.3	17.70	1141.7	21.68	1341.7	25.50	1025.0	6.00	725.0	4.60
60	916.7	17.40	1104.2	20.98	1341.7	25.50	1583.3	30.08	1250.0	7.20	850.0	5.15
*66	1100.0	20.90	1325.0	25.18	1623.0	30 85	.....	.....	1500.0	8.75	975.0	5.85
72	1283.0	24.40	1548.8	29.43	1904.2	36.18	.....	.....	1800.0	10.50	1125.0	6.65

*These sizes of cast-iron pipe not made; prices on them are approximated simply as a comparison.
Cast-iron weights shown above adopted as standard by American Waterworks Association, May 12, 1908.
Cast-iron prices based on current quotations of $38 per net ton, November, 1916.
Reinforced-concrete weights and prices averaged from manufacturers' standards.

vertical will greatly reduce the effectiveness of the reinforcing. Should the thrust become horizontal, or the pipe inadvertently be placed with its major axis horizontal under a vertical load, the pipe would develop but slightly greater strength than plain concrete. It is evident that the proper placing of pipe reinforced in this manner is a problem of some nicety and not at all foolproof. An additional disadvantage of the type illustrated in Fig. 4 is the fact that its shape will not permit of its use in extending existing culverts of cast iron or any pipe of circular section.

Thickness of Shell

Concrete pipe having a shell three times as thick as a cast-iron pipe of the same nominal diameter, or having the same weight per linear foot, is capable of supporting the same loads if properly made and reinforced. About 0.8 per cent of tensile reinforcing is the proper amount to produce a reasonable relation of stress in steel and concrete for pipes having this thickness. The reinforcing steel may consist of rods forming separate rings, some type of mesh, or continuous spirals. In the first two cases sufficient lap must be allowed to insure the steel taking full stress at any point. In any case the distribution of the metal throughout the length of the pipe should be unusually thorough, due to the vibratory character of the loads. The exact amount of the reinforcing will of course depend upon the thickness of the shell, and vary inversely with it; the more recent, and probably more logical, tendencies point toward the use of thinner shells and more reinforcing.

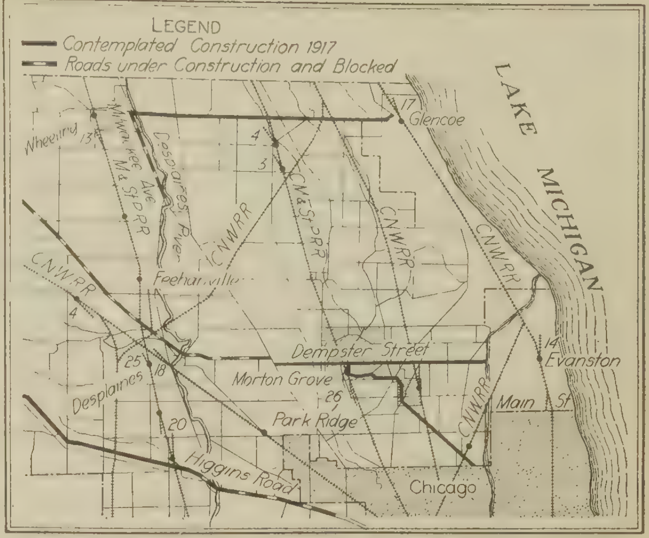
Prepares Maps to Help Road Contractors in Bidding

Cook County (Illinois) Highway Department Shows Sources of Materials, Condition of Roads and Other Useful Data

IN PREPARING to let contracts for $1,000,000 worth of highways in Cook County, Illinois, the county highway department has taken unusual care to give the bidders every scrap of information that would help them figure on the job. In addition to the usual data and specifications, two maps have been prepared, One shows the bidders the location of all sand, gravel and stone supplies within a reasonable distance of the various sections. Each of these material bases has been inspected, so that the contractor is assured that acceptable material can be obtained from them. This does not mean that there may not be other plants, but the list is thought to be as complete as it is economically feasible to make it.

Present Road Conditions

On a second map which is to be furnished to the contractors taking out plans are shown all sections of roads to be built this year and all now under construction and closed to traffic. All railroad sidings are marked with a figure indicating the number of cars that can be accommodated. This information was furnished by the railroads, many of which stated that extensions would be provided if necessary. The maps also show the boundaries of all municipalities. Some of the towns have traffic regulations which may preclude the use of heavy motor trucks without special permits. Camping privileges and other arrangements for housing the men may be effected in some cases.

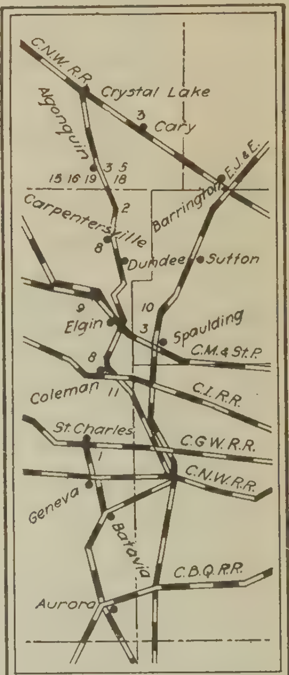


RAILROAD SIDINGS AND CONDITION OF ROAD SHOWN BY NUMBERS

As noted in the Engineering Record of Jan. 20, alternate bids will be taken for concrete of an average thickness of 7 in. and for asphaltic concrete 2 in. thick on a 6-in. macadam base, or on a 5-in. base of 1:3:5 concrete. Cuts and fills have been balanced each 1000 ft. Asphaltic concrete roads must be maintained for one year.

Higgins Road, 19 miles long, divided into two sections, will be one of the longest stretches of hard pavement under construction in the state. Six miles was let last year. The road will provide an outlet from the Chicago city limits to the county line. With 3½ miles of road under construction between the southern county boundary and the city limits, and ½ mile still to be done in Milwaukee Avenue on the north, there will be a paved highway of 60 miles north and south before the close of the season.

The smaller drawing is a reproduction of a part of the map showing the location of material bases. The other sketch was taken from the map showing the road now under construction and that to be built and indicating the location and capacity of railroad sidings. These two parts of the map show the value of the information to the contractor.



SOURCES OF ROAD MATERIALS AND NAMES OF COMPANIES INDICATED

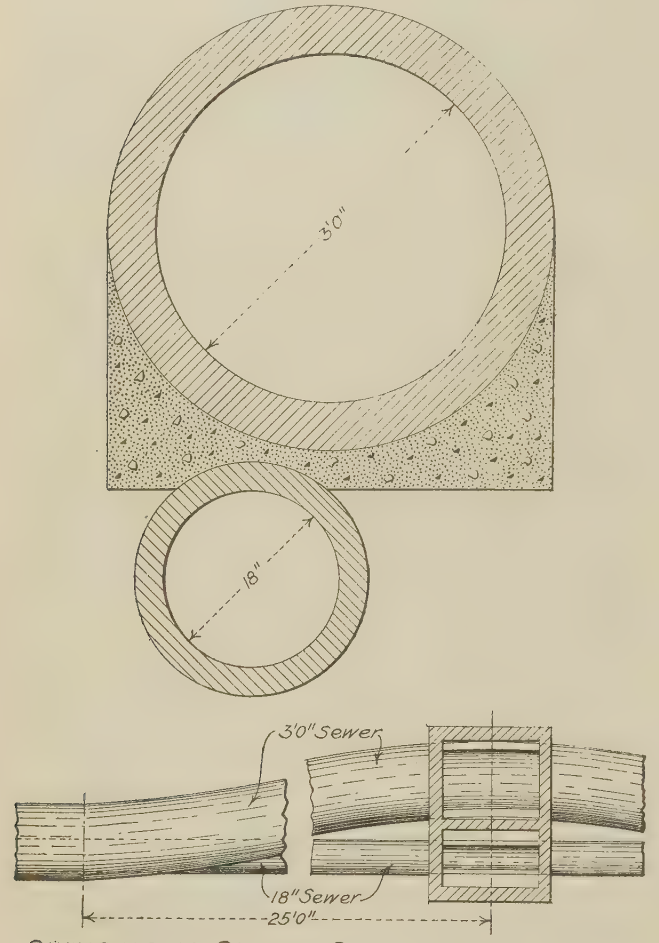
The first contract, to be let the first week in February, will be followed by lettings every other week. George A. Quinlan, 325 Court House, Chicago, is the county highway superintendent.

Two Sewers Laid in One Trench

Storm-Water Drain Placed on Top of Sewer and Offset to Allow for Combined Manhole Construction

By MANLEY OSGOOD
Consulting Engineer, Ann Arbor, Mich.

THE drawings show what I consider rather an unusual sewer design. In order to drain a low point in the city of Ann Arbor it became necessary to lay both the storm-water and sanitary sewers through a 28-ft. cut. The nature of the soil made tunneling impossible, and it was decided to lay both sewers in the same trench. The sanitary sewer is laid at the bottom and to one side of the trench, with the larger storm sewer on the top of it.



SWINGING OF STORM SEWER AT MANHOLE

ONE TRENCH CARRIES TWO SEWERS

Approaching manholes, the storm sewer, which was large enough for a man to go through, was swung, as shown, in a manner to allow the construction of combined manholes with a division wall between the storm and sanitary sewers. The smaller sanitary sewer was constructed perfectly straight to permit cleaning.

The storm sewer was made of American Sewer Pipe Company's segmental block, which, for proper construction, requires very rigid support on the under side up to the springing line. Inasmuch as the bottom of the trench was necessarily disturbed to permit the construction of the sanitary sewer, a concrete cradle was placed below the storm sewer through the deep cut.

Build Philippine Roads in Seven Years at Half Estimated Cost

Time Allowed to Complete System Was 17 Years—Actual Cost $18,500,000—Saving Due to Efficient Organization

BECAUSE of the cordial response of the Filipino people to the propaganda for good roads, elaborate projects and various types and widths of road were eliminated, and because of highly efficient methods and organization, rapid advances have been made in highway work in the Philippine Islands. The original time estimate for the construction of highways provided by legislature enacted in 1908 was 17.2 years; the system has been practically completed in 7 years. The estimated cost of the work was $37,250,000; only $18,500,000 has actually been spent. Therefore the work has been accomplished in about 41 per cent of the allowed time at a cost not exceeding 50 per cent of the original estimate. In 1909 it was estimated that 5710 miles of road was necessary. There was in existence on Jan. 1, 1916, 5085 miles of highway, according to the annual report of the Philippine Commission, recently issued.

Motor Trucks Hasten Road Work

Motor trucks have had their effect in the Philippine Islands as elsewhere. These vehicles are one of the factors which have greatly accelerated the progress of the road work in the last seven years. This kind of traffic has also increased the needs for good roads far beyond those of seven years ago. The opening of many new sources of supply of stone and the development of reinforced-concrete bridge work, while reducing construction and maintenance costs, have also operated to develop a great demand for similar work in territory unopened by the Spanish administration. While the road system, as it is to-day, fills the greater requirements of 1909, the need for new and better roads has grown with the development of the country.

Because it was feared that recent road building in the Philippine Islands was not justified by the traffic and that the maintenance would become burdensome, certain road policies were adopted in 1908 and have been strictly adhered to. One of these is that road and bridge construction work must be justified by traffic not only in existence but which is also productive. Projects whose only merit was the development of the country were not considered. Another requirement is that road-construction projects should be started only when funds were assured for their maintenance.

Situation Analyzed Before Roads Were Built

To insure the application of these principles a form of indorsement accompanied the estimate of cost of road projects. Among the questions considered were those of population, amount of traffic as shown by actual count, the products of the country traversed, the interest and the funds invested in the construction, and the cost of maintenance.

That the good-roads system is not burdensome to the country is shown by the regular adoption, twice a year for many years, of resolutions insuring the maintenance of first-class roads under the system specified by the insular government. Other proof of this is that the annual provincial road and bridge fund exceeds the amount required for maintenance by more than $500,000. Allowing an average annual maintenance charge of $403 per mile, it is estimated that the provinces can maintain not less than 520 additional miles of first-class road without allowing for natural growth in wealth and population and disregarding the increase in the road and bridge fund which will follow upon the reassessment of land.

Columbus Has New Crystal or Cake Alum Plant

Bauxite and Sulphuric Acid Alone Are Mixed and Then Allowed to Cake—No Boiling Tanks Are Necessary

RADICAL simplification of the home-made alum outfit at the water-purification plant at Columbus, Ohio, is indicated in one of the photographs herewith, which shows the old liquid-alum plant and the new crystal or cake-alum apparatus. Comparing this photograph with the one appearing in the Engineering Record May 8, 1915, page 576, describing the syrup-alum plant, it will be observed that the sludge tank at the left, provided in the original plant, has been removed and a platform built over the space occupied by the sludge tank. On this platform is located the mixing pan for making crystallized alum. Underneath it is the crystallizing pit. Bauxite is weighed out in the original weighing hopper over the alum boiling tanks. Acid is measured in the acid weigh box, which is also a part of the old plant. Definite amounts of bauxite and acid are discharged into the iron mixing pan and stirred for five minutes. Through a plug valve in the bottom of the pan the mixture flows into the pit, where it boils for a short time and then is crystallized.

The large lead-lined boiling tanks, with their complement of steam coils, are eliminated. This is made possible because no water is added to the mixture. Bauxite and acid are stirred together, the acid alone acting as the solvent. Considerably less acid is used than is chemically equivalent to the alumina bases present; thus there is no wasted acid, and the resultant cake is highly basic, from 10 to 14 per cent of the alumina content being basic. Since it is less stable than the acid-combined alumina, it dissociates quickly, producing rapid coagulation, large floes, and quick sedimentation.

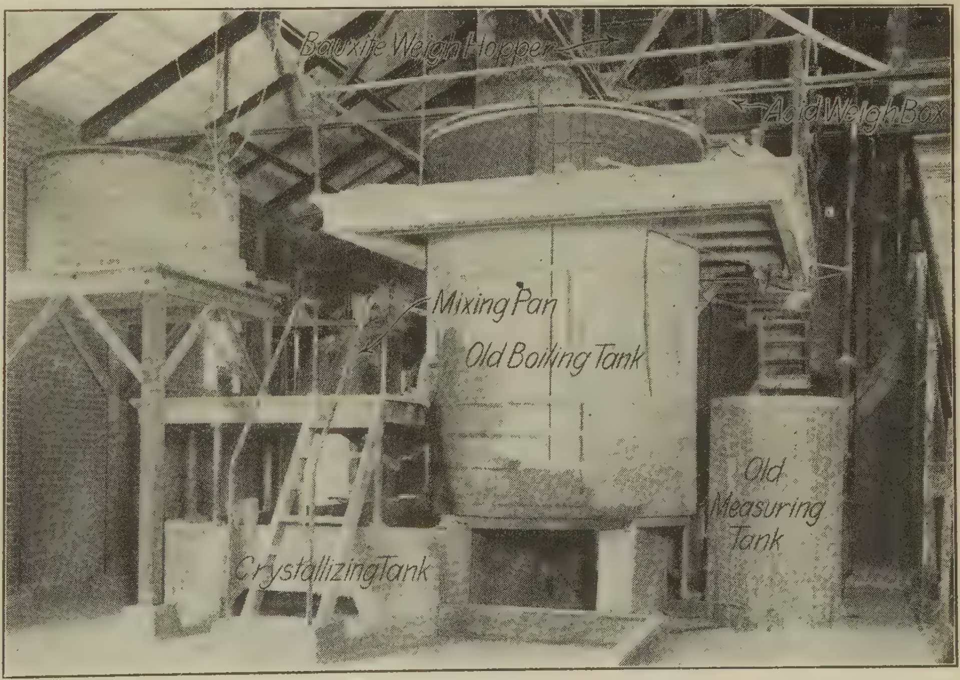
Cake alum made by the simplified process has all the advantages of the syrup for cold and clear waters, in that it has all the impurities which act as nuclei around which coagulation starts. In addition, the process is shortened, and the product can be handled and shipped with greater facility.

The Columbus plant was put into operation by Charles P. Hoover, chemist in charge, and the inventor of the process, prior to the installation of the elaborate iron-alum plant at Omaha, described in the Engineering Record of Oct. 7, 1916, page 435. At Columbus it is the custom to make up the cake one day and take it out of the pit in large slabs the following day.

Find Value of *n* in Kutter's Formula for Metal Flumes

U. S. Reclamation Service engineers experimenting on metal flumes of the North Platte and Uncompahgre Valley projects report that 0.012 is a fair average value for *n* in Kutter's formula for smooth interiors, and that 0.013 may be considered amply safe for design. Much higher values of *n* for flumes with protruding joints were noted, the average from the few experiments made on this type being 0.0185. Six experiments on No. 120 flume made on the Uncompahgre project in former years gave an average value of 0.0207. These previous experiments are of somewhat doubtful accuracy, but may properly be used to add weight to a cautionary statement that it is not safe to use a value of *n* much smaller than 0.020 when computing the capacity of a flume of the protruding-joint type.

ALUM CRYSTALLIZES IN PITS IN 3 TO 4-INCH LAYERS



RIGHT — CRYSTALLIZED ALUM PLANT ELIMINATES BOILING TANKS

Makes an Analysis of California's Water Problems

Data on Many Phases of the Use and Administration of Water Rights Collected by Water Problems Conference

AFTER spending a year investigating the subjects under its jurisdiction the State Water Problems Conference of California has published a 125-page report which presents an exhaustive analysis of present conditions and recommends a policy and procedure to the 1917 legislature. The conference automatically dissolved upon the completion of its work, but the various interests concerned with irrigation, reclamation and power development in the state are taking the report as a basis upon which to make urgent demands for action upon the legislature now in session.

The conference was created by a legislative act in 1915 with the lieutenant-governor as chairman and sixteen other members, including the chairmen of all state commissions involved and six representatives at large appointed by the governor. Instructions to the conference were to "recommend a unified policy with reference to irrigation, reclamation, water storage, flood control, municipalities and drainage, with due regard to the needs of water power, mining and navigation." The opening session of the conference was reported in the Engineering Record of Nov. 27, 1915, page 676.

PRELIMINARY ANNOUNCEMENT OF FINDINGS

In the preliminary announcement published with the "Findings and Recommendations" of the conference, after emphasizing the value of water resources in California, it was stated:

"That these water resources are to a great extent undeveloped, and that existing conditions do not lend themselves readily to development.

"That the problems involved in the development of these resources are greater in number and greater in magnitude than those which confront any other state in the Union, and that they are yet, to a considerable extent, unsolved.

"That these problems will remain unsolved and these resources to a great extent undeveloped until the state has established a definite policy with regard thereto and created authority with special powers to work out the problems and to direct the various matters having to do with the uses of water.

"That the state is not now in position to itself develop these resources, and, if they are not to be permitted to remain indefinitely in disuse, a source of great economic waste and a bar to progress, the state should so define her policies and frame the legislation necessary to carry them into effect as to secure the largest amount of active co-operation on the part of private capital and interested landowners, under conditions which properly safeguard state interest."

OVERDEVELOPMENT OF HYDROELECTRIC POWER

Data were placed before the conference indicating an overdevelopment of hydroelectric power for ordinary purposes in California, and showing that the real demand is for more markets rather than for more power. The conference found that the use of electricity per capita in California exceeds that of any other state, and that the purposes for which it is used are more varied, while the average rate per kilowatt-hour for all purposes is less. No proof, however, was found either that California is using all the electrical energy it can, or that energy cannot be furnished at a still lower rate. In the suggestions made by the conference, new uses for water power are indicated.

POLICY OF RAILROAD COMMISSION

The policy of the Railroad Commission in refusing to permit new power companies to enter territory already served is referred to as "fraught with one apparent disadvantage." Since rates are fixed on the basis of cost of service to the company, the installation and operation costs of plants put in years ago often lead to a service charge greatly in excess of that which would be sufficient to cover the costs with a modern plant using the same source of energy.

"While the old plant of the established company may have been displaced in large part by a modern one, its cost is still represented by bonds and stock on which interest is allowed by the commission, and paid in rates by the consumer. Theoretically the public should have the advantage in rates justified by latest methods and improved machinery. Undoubtedly the rates are in a number of cases considerably in excess of the rates which would return fair profit on a modern plant; but, on the other hand, they may not be higher than the rates which the consumer would ultimately pay if a competing company came into the field and in time absorbed or was absorbed by the old company. This probably is the reason for the commission's action."

RECOMMENDATIONS OF CONFERENCE

These are among the findings extracted from the report. The private development of natural resources must be encouraged and legislation should be directed toward securing the conservation and use of water power, at the same time safeguarding private rights and reserving to the state the privilege of assuming control upon payment of a fair consideration.

State authority in water matters should be vested in three state commissions, with jurisdiction so regulated as not to clash, and with powers similar to those enjoyed by the Railroad Commission. These might quite properly be (1) a state flood-control board, which would supersede the present State Reclamation Board, (2) the present State Irrigation Board, and (3) the present State Water Commission, the latter to have authority over all water matters not within the jurisdiction of the other two boards. A satisfactory solution of state water problems calls for "several years' work of these three boards even if composed of the ablest men to be found in the state."

TO MINIMIZE RIPARIAN-RIGHT EVILS

Recognizing that it is too late to abrogate the common-law doctrine of riparian rights, which under court decisions has become a property right, measures likely to minimize the existing evil are recommended as follows: "(a) A law empowering the court to determine the amount of damage sustained by a complaining riparian owner and the conditions under which the proposed interference with his riparian rights may continue; (b) a law prohibiting the issue of an injunction on application of a riparian owner unless damage is shown, and (c) a law limiting the time within which a riparian owner may bring action to protect his rights to three months after notice of the work of which he complains."

The fixation of nitrogen, the smelting of iron and steel in the electric furnace, the manufacture of electrochemical products and the increase in the consumption of current for common uses offer possibilities to a state where the available hydroelectric power now being wasted would cost annually $168,000,000 if produced by steam. Recommendation is therefore made that an investigation be made at once as to what extent and how the available power can be profitably utilized, that state policies in these matters be determined and that efforts be made to secure such modification of prohibitive or restrictive federal legislation as will encourage embarking of private capital in power plants while properly safeguarding public interest; and that the state, by encouragement and aid, foster such enterprises.

IRRIGATION SUPERIOR TO NAVIGATION

Irrigation is recognized as a superior beneficial use of water to navigation. It is recommended that if in the future it shall appear necessary to take out of a navigable stream for irrigation so much of its flow as to endanger navigation, then if such navigation be necessary in the state's interest for insuring profitable markets for the products of irrigation, navigation shall be maintained by canalization. Mining, too, is recognized as an inferior right which will have to yield to irrigation when the two conflict.

It is recommended that comprehensive plans for flood control and reclamation suited to the various sections be formulated and that the construction and administration of internal affairs be carried out by the various districts, the state authorities simply exercising general laws to secure efficient administration. A general plan of state aid in reclamation, irrigation and similar enterprises is recommended, the arrangement being such that the state's credit be extended to such projects as have been approved by the proper state authorities. This would save the loss of the 15 to 30 per cent discount now often necessary to the sale of such bonds, and at the same time delinquency measures could be provided to protect the state against non-payment of assessments.

TEMPORARY FINANCIAL AID

Pending passage of a constitutional amendment sanctioning state aid in such enterprises it is recommended that temporary relief be provided in the shape of a revolving fund of $500,000, from which any coupon of an enterprise which has been approved by the proper state commission will be paid on demand. Protection for the state shall be secured by a provision permitting the state to take over administration of the enterprise when payments thus made exceed 15 per cent of the current interest due for one year.

The doctrine of prior appropriation should apply to underground waters so that he who first makes beneficial use of the water shall have the right to as much as is necessary for the purpose to which it is applied. Whenever it is practicable to care for flood waters by storage, co-operation among the various interests concerned must be encouraged so that projects not economically justified for one interest alone may be carried out. It is recommended that the state exercise full control over the construction and maintenance of dams, with full power to prevent their use unless declared safe.

To reduce materially the great expense and delay involved in water litigation it is recommended:

(a) "That the findings of the three state water commissions be final as to all matters of fact.

(b) "That expert witnesses be no longer allowed to testify as such in behalf of either side; that a court expert be appointed when necessary, by agreement between the parties to the suit, or, if they cannot agree, then by the court; and that each side may cross-examine the expert as to matters concerning which he testifies.

(c) "That a superior judge be selected by the governor to try all water cases, in accordance with the principle already established in connection with trial of reclamation cases. Such a plan would greatly reduce the number and expense of Superior Court trials as necessitated by the present system, and would tend to free them from local influence and prejudice.

(d) "That procedure in the exercise of the right of eminent domain by a state agency be so changed as to avoid delays. . . . It is proposed to adopt the plan successfully followed in Mississippi and Arkansas, under which possession of the property is secured at once by payment of its valuation as fixed by the court. Subsequent proceedings are had to determine finally the value, and the necessary adjustment is made by payment of more money, or by return of a portion already paid, as the case may be."

TO UNIFY STATE POLICIES

It is recommended that in order to unify state policies the legislature submit to the three water commissions all bills pertaining to the use or control of water rights and that the commissions be required promptly to report back to the legislature. The conference believes unwise the policy which allows a municipality to tie up indefinitely unlimited quantities of water to meet anticipated needs of a remote future. It recommends instead that the State Water Commission be authorized to make reasonable provision for future development of municipalities.

October Railroad Income 8.7 Per Cent Better Than in October, 1915

Gross operating revenues for October, 1916, on the large steam railroads of the United States, according to a bulletin issued by the Bureau of Railway Economics, were $1,466 per mile, showing an increase of $143, or 10.8 per cent, as compared with October, 1915. Operating expenses were $910, an increase of $95, or 11.7 per cent. Net operating revenue therefore was $556—an increase of $48, or 9.4 per cent, and operating income was $495, an increase of $40, or 8.7 per cent. The operating ratio was 62.1 per cent, as compared with 61.6 per cent in October, 1915. Considering the three main districts, the respective ratios for October, 1916, and October, 1915, were as follows: Eastern, 66.9 and 63.4; Southern, 62.6 and 66.2; Western, 57.0 and 58.2.

Oregon Society of Engineers Wants Timely Discussions

News of Activities of the Society Secondary to Criticism of Articles with View of Developing New Ideas

BELIEVING that the journal of an engineering society should do more than record the activities of the organization, and that the official publication should be the clearing house of ideas and made to serve as a vehicle in the constructive work, the Oregon Society of Engineers has issued a call for "copy" to be used in a "discussion" department of its organ. The publication committee, of which H. L. Vorse is chairman, has made the following appeal:

"Your society, in directing this committee to make a success of the *Journal*, authorized it to commandeer such of the mental energy of the members as would seem to be useful. We believe the *Journal* should represent something more than the mere doings of the society. It should become a clearing house of ideas—a medium for pleasurable enlightenment of members and others—and it should be made to serve us as a vehicle in our constructive work both in our individual upbuilding as well as in our united professional thrust forward for greatness.

"The engineer never had a better opportunity than to-day to claim his own, and the measure of his ultimate success will be the keenness of realization of his present advantage. Don't hide your light under a bushel. If the engineer possessed one-half the social and political acumen of any other professional man he would be on the throne of greatness instead of wishing to be.

REDUCE THOUGHTS TO WRITING

"Suggest a topic for discussion by the society. Elaborate it just a little—inject a bit of original thought and dress it off with a very short peroration and launch it purely as a speculation.

"If we were to propound as thesis 'Should the federal government own and operate all transcontinental railroads, leaving only feeders to private ownership?' we feel sure you would bud ideas with the reading of the subject. You would be for it or against it, and you would know why and be able to give your view. If in that case you would reduce your words to writing and send the manuscript in, we probably would have something of value.

"Remember that every publication is being scanned very closely now for ideas that make for progress in the nation's social and industrial preparedness. Remember that one's own remarks, if well chosen and indicative of a fertile mind, not necessarily backed with experience, could, and frequently do, prove the shafts that hit the mark and transform a mediocre career into one of vast power for good and extended leadership, in thought and action, of the multitudes who must ever be led.

"We must first conquer in the fields of expressed opinion before we may be permitted on the stage of action. We defy you to name one individual who has attained a dignified prominence that did not come primarily from his written or spoken words rather than from some mere act of usefulness.

"There are fertile fields scarcely touched in which discussion may bear fruit. The labor problem is an old one considered in the abstract; but who ventures to say we are not entering upon a page of unwritten history? Consider the labor problem in all its aspects —in the light of recent federal legislation, finished and yet to come; the actual labor supply to-day and what it will be at the close of the war; the present pressing need for menial labor and for a time at least skilled labor; the question of hours, pay and the necessity for getting things done.

"In suggesting subjects, deal with the various affairs of life and get away from the purely technical or mathematical problems of the day. You should remember, too, that the six papers of this issue and a like number of the first issue of the *Journal* should furnish you material for discussion. Or do you agree with everything said? We do not; we presume you should not. The authors of those papers made no pretext at exhausting the subject. We think they merely scratched it in several instances. A 'discussion' department of the *Journal* is waiting for copy."

Gives Instructions on Care of Earth Roads in Winter

Illinois Highway Engineer Recommends Use of Drag Before Freezes, Watching Weather Predictions for the Exact Cue as to Time

THE FIRST way to care for an earth road in winter, according to a statement by Frank T. Sheets, assistant maintenance engineer, Illinois Highway Department, in the December issue of *Illinois Highways*, is to prepare it for this care by intelligent work in the summer, paradoxical though the statement may seem. No one should expect or permit an earth road to enter upon the winter period in a flat, undrained condition. The road should be well crowned, adequate side ditches provided and underdrainage placed wherever deemed necessary.

In winter it is essential, says Mr. Sheets, that the ditches, drains and culverts be watched and all obstructions to drainage removed. A few minutes' use of a shovel may eliminate a saturated roadbed or a stopped-up culvert. Keep the ditches and culverts clean. Then when rain falls or snow and ice melt, far less damage will result.

It is unavoidable that the surface should be cut up under traffic during a thaw or a rainy spell. Yet no one can say that it is necessary to let this surface freeze in such a condition. Nothing more unpleasant can be experienced than traveling over a rough, rutted and frozen surface.

The road drag comes to the rescue of the earth road in winter with the same efficiency as in summer. If a rough, cut-up road is dragged before a freeze and then frozen in a smooth condition, a boulevard is enjoyed until the next thaw. If a wet surface is dragged and then dried, a good road is also enjoyed.

Common sense will soon teach how to perform the work. A study of weather predictions and a corresponding use of the drag at opportune times will work wonders in the winter with Illinois roads.

To Compute Stress in Spiral-Riveted Steel Pipe

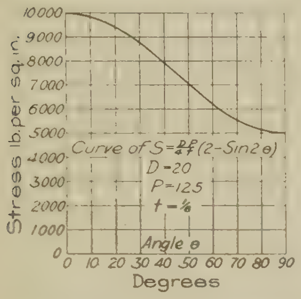
Theoretical Analysis for Normal Stresses in Gross Sections of Joints—Diagram Shows Variation with Angle of Spiral

By ARTHUR JOBSON
Casper, Wyoming

THE DESIGN of spiral-riveted pipe is of course directly dependent on the angle of spiral. An analysis to include the effects of both longitudinal and radial forces induced by internal pressure is here presented, together with a diagram to indicate the variation of stress normal to the joint with the angle of the spiral. There is also derived a formula for angle of spiral for a given riveted joint efficiency such that the strength of the joint will be equal to the full strength of the plate on a longitudinal section.

NOTATION USED

In order to derive the desired equations, the notation shown on the drawing herewith will be used, and in addition P is the internal pressure in pounds per square inch; F_1, the total force $\pi D^2 P/4$ acting parallel to the axis of the pipe due to the internal pressure; F_2, the corresponding total force $DLP/2$ acting normal to the preceding and tending to rupture the plate longitudinally; R, the resultant of F_1 and F_2 normal to the direction of the spiral joint; t, thickness of plate, and θ is the angle between the joint and the longitudinal axis.



VARIATION IN UNIT STRESS WITH ANGLE

There can then be written:

$$R = F_1 \cos (90 - \theta) + F_2 \cos \theta$$

$$= F_1 \sin \theta + F_2 \cos \theta \qquad (1)$$

$$= \frac{\pi D^2 P \sin \theta}{4} + \frac{DLP \cos \theta}{2} \qquad (2)$$

To find the unit stress S in the plate (in pounds per square inch) produced by the resultant force R, it is necessary to divide this force by the area of the plate normal to R. For convenience, assume that the length of the section under consideration is equal to the pitch p of the riveted joint. Then the area of the plate normal to R will be $tp \sec \theta$, and substituting $L = p$, there is obtained

$$S = \frac{\pi D^2 P \sin \theta \cos \theta}{4tp} + \frac{DP \cos^2 \theta}{2t}$$

But $p = \pi D \cot \theta$; therefore

$$S = \frac{DP}{4t} (\sin^2 \theta + 2 \cos^2 \theta) \qquad (3)$$

Substituting the value of the cosine in terms of the sine, equation 3 reduces to:

$$S = \frac{DP}{4t} (2 - \sin^2 \theta) \qquad (4)$$

It will be noted that for the limiting values of θ the last equation reduces to the usual expressions for computing the circular and longitudinal unit stresses in closed cylinders subject to internal pressure. For instance, when $\theta = 0$ deg. the helix becomes a longitudinal line and $S = DP/2t$, and when $\theta = 90$ deg., $S = DP/4t$.

The table herewith gives the values of $2 - \sin^2 \theta$, S, and the pitch p in inches for values of θ from 0 to 90 deg. The unit stress S is computed on the assumption that D is 20 in., P is 125 lb. per square inch and t is ⅛ in., gross section.

UNIT STRESS S AND PITCH p FOR VARIATION IN ANGLE θ

θ	$2 - \sin^2 \theta$	S	p
0	2.0	10,000	∞
10	1.9697	9,848	356
20	1.883	9,415	173
30	1.75	8,750	109
40	1.5865	7,933	75
45	1.5	7,500	63
50	1.4132	7,066	53
60	1.25	6,250	36
70	1.1164	5,582	23
80	1.03	5,149	11.1
85	1.008	5,040	5.5
90	1.0	5,000	0.0

The variation of the unit stress for corresponding values of the angle θ is shown graphically in the diagram.

It will be noted from the table that the stress in the plate normal to the direction of the spiral joint when θ has a value of 70 deg. is about 56 per cent of the unit stress longitudinally. As this is about the efficiency of a single-riveted lap joint, it is evident that the pipe is not appreciably weakened by a joint; in fact, the results indicate that for values of θ greater than 70 deg. the joints are considerably stronger than the full area of the plate on a longitudinal section.

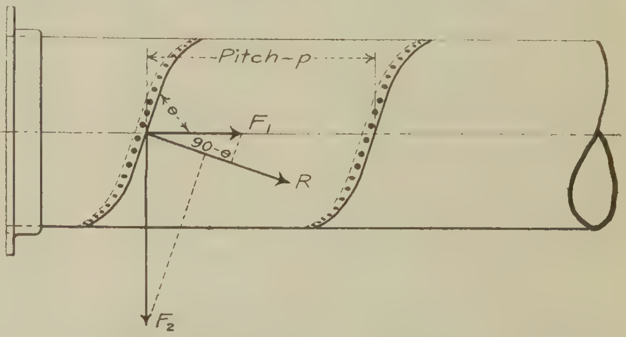


DIAGRAM SHOWING NOTATION USED

To find the angle θ for a given riveted joint efficiency such that the strength of the joint will be equal to that of the plate for a longitudinal section, let E be the efficiency of riveted joint in per cent, and S_2 the longitudinal unit stress; there can then be written:

$$S_2 = \frac{DP}{2t} = \frac{100DP}{4Et} (2 - \sin^2 \theta)$$

Solving, there is obtained:

$$E = 50 (2 - \sin^2 \theta) \qquad (5)$$

$$\sin \theta = \sqrt{2 - E/50} \qquad (6)$$

The angle θ is easily found in any particular case by measuring the diameter of the pipe and the length of the pitch, and substituting these figures in the expression $\tan \theta = \pi D/p$.

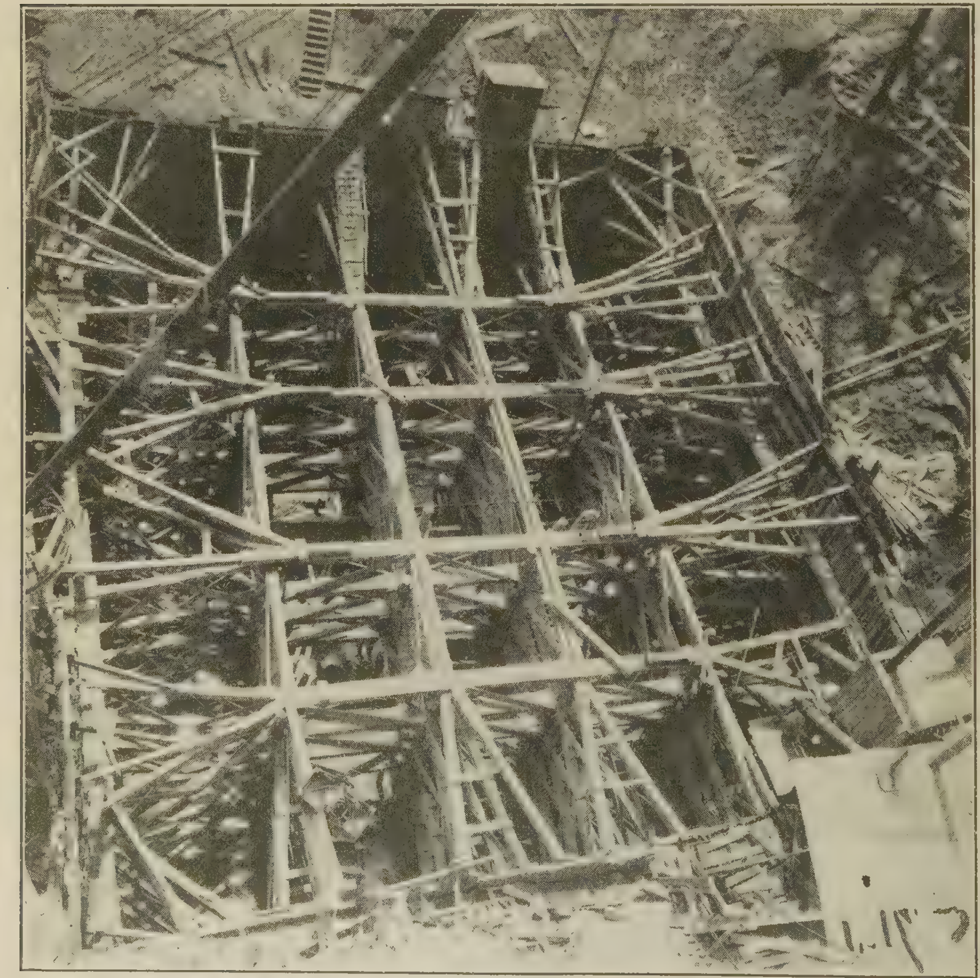
The value of θ given by equation 6 may be considered the critical angle for a given riveted joint efficiency. That is, for any angle between this critical value and 90 deg. the spiral joint will be stronger than the longitudinal section of the plate, and for angles smaller than the critical value the riveted joint will be weaker than the longitudinal section.

Heavy Bracing Gives Large Open Pockets in Deep Cofferdam

Power Plant on Ohio River Requires Large Amount of Scattered Tunnel, Foundation and Concrete Work—Problem to Get Gravel from River to Job

A VERY LARGE braced cofferdam, excavated to the unusual depth of 65 ft. below the surface, has recently been used with success in building a reinforced-concrete condenser pit for a big steam-electric power plant at Beach Bottom, 8 miles above Wheeling, W. Va., on the Ohio River. The condenser pit is for the first of three units, each of which will generate 30,000 kw., using coal delivered from a mine directly behind the plant, and transmitting power across the river for use in that section of Ohio. Besides the main cofferdam, for which a type of bracing giving large open pockets was developed, the work also includes deep open-well foundations for the boiler plant and for the transmission-line towers on both sides of the river, and inlet and outlet tunnels emerging below low water, the ends of which were inclosed in an open-box cofferdam in the river. The variable river stage, and the fact that the Pennsylvania Railroad lies between the main buildings and the river, from which sand and gravel were obtained, gave rise to an interesting problem in material supply.

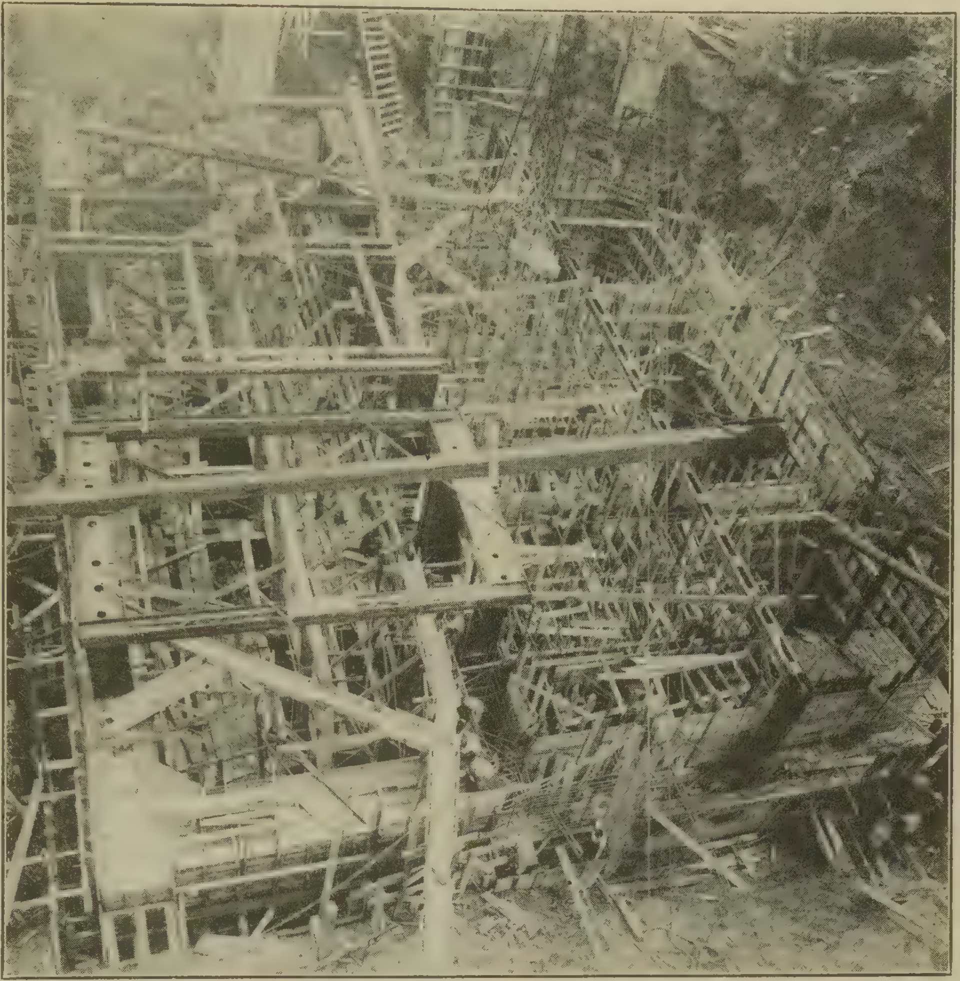
The work was developed with stiffleg derricks placed on piles around the open pit in which the main cofferdam was started. This pit was dug 20 ft. deep with grab buckets over the site of the main power plant. The spoil was disposed of south of the plant by dump-car trains and two steam dinkeys. Wood sheeting 4 ft. outside of the proposed lines of the steel coffer was then driven 12 ft. deeper and excavated. The top layer of bracing was next placed and 40-ft. arch-web Lackawanna steel sheeting stood up around it and driven to rock with steam hammers. The bracing was designed with built-up members able to sustain triple the load allowable on a 12 x 12-in. timber. This made possible large pockets, in which dredging could be done cheaply, and in connection with the arch-web sheeting permitted a 6-ft. vertical span between layers. This construction gave one-third the usual number of cross-struts to handle in carrying up the concrete, and made both formwork and concreting much easier. As will be seen from the photographs, the struts parallel to the river consisted of two 12 x 12-in. timbers on top and one beneath, while those perpendicular to the river were made with one timber on top and two beneath. A central group of nine pockets was formed in this way, from the corners and intersections of which single 12 x 12-in. timbers ran fanwise to the wales, each of which was made with three horizontal courses of 12 x 12-in. timber.


EACH LINE OF BRACING ACROSS HUGE COFFER IS MADE OF THREE 12 x 12s

TUNNELS STARTED FROM RIVER

While this cofferdam was being excavated and braced two derrick boats dredged and built a box coffer around the river end of the intake and discharge tunnels. This work was started in the fall of 1915, and a traveler derrick, set up above the line of the tunnels, began to sheet and excavate a trench for them as soon as the coffer had been pumped out. The tunnels had been built and backfilled to the edge of the high river bank when winter and spring floods interrupted work on them until this summer. They have been driven through beneath the railroad in timbered tunnels to meet the sections constructed inside the condenser-pit cofferdam during the past season.

The same rises in the river were taken advantage of, however, to stock 11,000 yd. of sand and gravel on the top of the bank between the railroad and the river. This material was dug by a sand dredge, loaded into barges, and cast by one of the derrick boats on the bank at the water's edge. A traveler derrick picked it up here and stacked it at the top of the bank. A second traveler, moving into these piles, has this year loaded them, using a portable hopper, into dump buckets on flat cars which are hauled to the concrete plant by a dinkey through a small tunnel under the railroad.



LARGE OPEN POCKETS IN BRACING NEEDED FOR HEAVY STEEL AND CONCRETE CONSTRUCTION

Though this triple handling may seem expensive, no substitute for it was feasible. The Ohio has its moods, in some of which the shoal bottom on the east side at this point is exposed 300 ft. from shore, and in others of which ice and driftwood are swept along at a rate that would make short work of a material trestle. Frequently the sand dredge could not work at all. The only insurance of continuous concreting was a large stock pile. Considering the 40-ft. range of the river, and the fact that a traveler derrick submerged for a few days comes up ready to run, while a conveyor or similar device would be lucky to come up at all, no cheaper method of handling the aggregate could have been found.

However, storage space was limited, and the river erratic. Enough material to complete the job could not be handled in this way, and a trestle, built this summer out to deep water, and ending under a hopper fed by a derrick boat, was used as continuously as possible, the last of the storage pile serving as a reserve.

The concrete plant, covering with a tower and a spouting system the main power plant, is located north of the cofferdam. Its 1-yd. mixer is set under 30-yd. bins into which a derrick dumps the 1-yd. material buckets. Cement is delivered by rail to a four-car cement house adjoining the plant.

The concrete for the transmission-line foundations on both sides of the river was mixed in portable mixers. A mixer of this type was also used for concreting the

BIG INTAKE WELL AT RIGHT CONNECTS WITH OHIO RIVER THROUGH TUNNELS UNDER RAILROAD AT LEFT

MacArthur piles, 215 of which were driven for the support of the apparatus-shop building north of the main plant. For the open-pit foundations, from rock up to ground level, concrete was spouted directly into the rectangular wood-sheeted wells. Above that point it was handled by the skid derricks which sunk the wells. The small amount of cement and aggregate required on the west bank was thrown up by a derrick boat and loaded by a traveler into wagons which took it to the tower sites.

EXTRA PLANT, FROM DAM COMPLETED BELOW, PUT TO GOOD USE

After the concrete work in the condenser pit had been given a good start, work was begun on as many of the wells outside of it, which will support the rest of the main plant, as were not beneath the derricks required to handle the heavy structural-steel reinforcing in the condenser pit and pull the steel sheeting. As these wells were finished additional derricks were set on them and used to take the original derricks down. This procedure, which saved many days' delay over shifting the first derricks, was possible without extra cost because more plant than was actually required on the job had been released by the completion of government dam 12, 5 miles downstream, and brought to Beach Bottom on the company's barges by a river steamer built for constructing the dam. This steamer and the sand digger, a side-ladder dredge also used at the dam, considerably cheapened the cost of supplying aggregate for the power-plant contract.

Most of the construction above ground is steel frame with brick walls and concrete floors. By the end of July last the foundation work had advanced sufficiently for the steel contractors to make a good start on erection, and the structures above ground are now nearing completion.

SAVING STEPS FOR THE MECHANICS

The job is equipped with a woodworking machine and blacksmith shop, placed end to end with each other and the storeroom, south of the work. The steel and pipestock racks are arranged against the buildings. In this way the high-priced machinists, pipefitters and carpenters do not have to waste time looking all over the work for tools and materials with which to do little jobs. The carpenter shop contains band and rip saws, and the machine shop is equipped with threading tools, a lathe, and a drill press.

The plant was designed by Sargent & Lundy, engineers for the owners, the American Gas & Electric Company. The Foundation Company is general contractor for the entire work. Operations are under the direction of George R. Johnson, district manager, with H. B. Kelsey in charge as superintendent.

Longest Concrete Road in Utah

With the completion of a 3-mile stretch of 16-ft. concrete road from Lagoon to Kaysville, on the highway between Salt Lake City and Ogden, Utah, approximately one-half of the 37-mile stretch between Salt Lake City and Ogden will have been completed. This, according to the Portland Cement Association, will make one of the longest continuous stretches of concrete in Utah.

Profession Defined—Wage-Earning Engineers Not Yet Members

F. H. Newell Tells Cleveland Engineering Society How Best to Serve Men Who Have Not Reached Goal as Well as Those Who Have

WHAT distinguishes the professional man from the mechanic was set forth to the Cleveland Engineering Society at a meeting last November by F. H. Newell, professor of civil engineering at the University of Illinois. In his address, "A Practical Plan of Engineering Co-operation," he defined a profession as "a calling in which one professes to have acquired some special knowledge used by way either of instruction, guiding or advising others or of serving them in some art." Under his definition engineering societies are made up largely of men not yet professional men, though aspiring to be. Hence he holds that the societies must modify themselves to serve these men, as well as those who have arrived, and he cites four lines—employment, publicity, better laws and ethics—in which the societies can assist its members.

Extracts from his address follow:

WHAT DISTINGUISHES A PROFESSION

"The first and most distinctive feature [of a profession] is the fact that the doctor, and the lawyer as well, does not work under the immediate direction of some other person, nor does he perform certain set operations within certain hours. He is called in not to carry out instructions of an employer but, on the contrary, to dictate to the man who ultimately pays the fee when, where and how certain things must be done. He ceases to be a professional man the moment he takes orders from an employer.

"More than this, the doctor, the lawyer, and the minister as professional men glorify in the fact that they set the practice of the profession above remuneration. They have devoted their lives to a certain work for the love of the work and not for the money rewards. To the needy their services are free; no mechanic is called upon to work for nothing—the doctor frequently is. In theory, at least, they do not accept direct pay for so many hours' service, but finding it necessary to live and maintain a suitable status in society they accept a fee, a retainer, a stipend, or an honorarium—never wages.

"This matter of wages, salary or fee is an index of the consensus of opinion as to what is or what is not a profession. It is not, of course, the way in which the money itself is paid or received, but the underlying theory as to whether on the one hand you are working under the direction of someone else who is dictating how you shall work, or, on the other, whether you are exercising the rights and duties of a professional man in determining how your patient or client shall or shall not conduct his affairs.

WAGE EARNERS NOT STRICTLY PROFESSIONAL

"The moment we recognize clearly the fact that the men who join the engineering societies are not as yet professional men, although looking forward to that condition, then it follows that we must modify our organizations and methods to accomplish the largest good to the greatest number. With this condition in mind, namely, that while some may be professional men in the strict sense of the word, yet the great majority, particularly of our younger men, are not professional, but are more of the nature of wage earners, we must look around us and see what similar organizations of other men are doing. We must try to help each other by an exchange of ideas, by an exchange of experience, so that we as an organization may perform our full duty, not only to our own members, but to the public in general.

CONFUSION IN GROUPS

"We must clearly face this confusion and must endeavor to distinguish and straighten out the lines between the mechanics, often miscalled engineers, the real engineers who are technically educated and are serving as employees, the business men who are educated as engineers and who are properly members of an engineering organization, but who are in engineering as a business; and the independent practitioners who originally built up the older engineering societies, largely following the precedents set by the organization of the doctors and of the lawyers. The times have changed and this confusion of terms must bring about a great deal of discussion, a conflict of ideas. Thus we must, when considering the function of the engineer, clearly distinguish as to which of these kinds of men we have in mind and what are the classes of men to be benefited by our organization.

DUTIES OF LOCAL ENGINEERING SOCIETIES

"Under that assumption, that the majority of the members of our local engineering associations are not professional men as yet, but should have before them the ideals of the professional man that they may grow into the profession, what are the things most important for this association and for all associations to do for the benefit of its members and of the public in general?

"When we recognize that any local engineering society must necessarily be composed not merely of a nucleus of professional men, but to a large extent of young men technically trained and competent to become professional men, then we see more clearly the answer to these questions. Our activities must be directed toward the needs not merely of the small number of mature engineers but, more than this, to the proper relations of the younger men. These needs may be enumerated under several headings, in each of which the Cleveland society has already distinguished itself. They must be considered under the headings (1) employment, (2) publicity, (3) better laws and (4) ethics."

EMPLOYMENT, PUBLICITY, BETTER LAWS AND ETHICS

On the score of employment Professor Newell cited the handicap under which the engineer labors when out of work, mainly because his pride and professional ideals prevent him from proclaiming his abilities. The engineering society, Professor Newell thinks, "should say things for him that he cannot say for himself and that he cannot ask us to say," providing him with something akin to employment insurance; and at the same time it should strive to the end that "the square pegs may fall into the square holes and the round pegs into the round holes."

Publicity of the right sort, in the estimation of Professor Newell, is the establishment and maintenance of good understanding on the part of the public as to what engineers are doing. This does not mean self-seeking advertising. It does mean putting out "clearly and frequently statements acceptable to the daily press which systematically bring about the proper appreciation of engineering work."

Under the third head, better laws, Professor Newell urges the engineer and engineering societies to take a more active part in revising the laws to meet the exigencies of modern changing conditions. And as to ethics, he urges that it be no longer assumed that the engineer is honest because he is an engineer, but that much more attention be given to the discussion of codes and their enforcement by local associations. Only thus, Professor Newell thinks, can men of high ideals be protected against the less scrupulous.

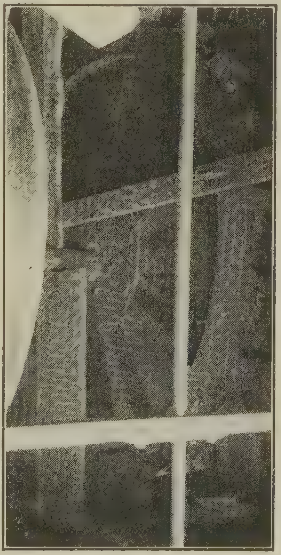
California Waterwheel Built in 1868 Still in Service

76-Inch Wheel with Built-Up Wood Center at Quincy Sawmill Was Much Improved in 1880 with Remodeled Buckets

By J. W. SWAREN
Hayward, California

NEAR Quincy, Cal., one of the oldest operating waterwheels on the Pacific Coast is driving a sawmill cutting lumber for local needs. It was built in 1868, remodeled in 1880, and is still in regular service when required. It has a built-up wood center, 76 in. in diameter at the pitch line, with an 8-in. face. It has a 3-in. wrought shaft, with wrought side plates. A built-up wood pulley for the driving belt is mounted on the shaft.

Pine, cut with whipsaws and hand-dressed, was used in building up the center, hand-forged nails and through bolts reinforcing the dovetail construction. Some type of compound, the nature of which could not be ascertained, was applied to the wood sections, and in general appearance these seem of recent construction. A close examination, however, confirms the age. When the untreated planking that incased the wheel was removed to permit photographing, much of it crumbled into dust.



WATERWHEEL NEARLY 50 YEARS OLD STILL ON DUTY

As originally built, it had flat wooden buckets dovetailed into the rim. During the summer of 1880 Lester A. Pelton, who had just completed the development of the divided bucket, replaced these wood buckets with cast-iron buckets, doing the work in person. Old residents comment on the increased output of the sawmill after the new buckets were installed.

The original nozzle, 1¼ in. in diameter, is still in service, though rather water-worn. It operates under a head of 125 ft. Sheet-iron pipe, of the type used for supplying hydraulic giants in the early mining days, is used for the penstock.

This wheel is on the ranch of H. C. Fluornoy, manager of the Quincy Light & Power Company, and son-in-law of Judge Ganser, who made the original installation.

In strange contrast to this unit is the unit of the power company less than a hundred yards distant, which is equipped with every possible refinement that the hydraulic engineer can devise in order to secure maximum output from a limited stream flow.

Trench Construction Now Governed by "Safety Orders"

California Accident Commission Prescribes What Shoring Must Be Used for Different Depths and Kinds of Material

THE workmen's compensation and insurance act of California passed in 1913 empowers the Industrial Accident Commission "to make and enforce safety orders and to fix safety standards." In line with its policy of extending its supervision to all fields of construction where safety regulations are needed, the commission has just issued a set of "Trench Construction Safety Orders," effective Jan. 1, 1917.

Committees, including representatives of large contracting firms, the Accident Commission, municipalities, the Casualty Underwriters' Association of California, the Central Labor Council, and the United Laborers' Union, met and agreed upon limitations which the commission has embodied in safety orders 1000 to 1006 inclusive. These orders will hereafter govern in trench work over which the commission has jurisdiction.

Piling and Shoring

After defining a trench as "any excavation, other than railroad or highway cuts, in which the greatest depth is equal to or greater than the width," the orders state that "where running material is encountered the sides of all trenches 4 ft. or more in depth shall be secured by the use of sheet piling and suitable braces, as defined in these orders.

"Where trench is between 4 ft. and 7 ft. in depth, wooden sheet piling shall be not less than 2 in. in thickness. Where trench is over 7 ft. in depth, wooden sheet piling shall be not less than 3 in. in thickness.

"The sides of all trenches in hard, compact material which are 5 ft. or more in depth and over 8 ft. in length shall be securely held by shoring and bracing. If the unit-tunnel method is used, the length of earth left in place between the separate unit trenches shall be not less than one-half the depth of the trench, and shall be considered as taking the place of shoring and bracing.

"All trenches of over 8 ft. in length and 5 ft. or more in depth in hard, compact material shall be braced at intervals not exceeding 8 ft. with 2 x 6-in. planks, or heavier material, placed vertically in the trench opposite each other against the walls. These braces shall, if possible, extend to the bottom of the trench; otherwise as low as possible to clear the top of pipe, sewer, conduit or other material to be placed in the bottom of the trench.

"The braces in trenches shall be supported by screw jacks or by timbers placed normal to both braces, cleated and rigidly screwed or wedged. The timbers shall be not less than those given in the following table:

Width of trench, ft.	Size of timbers, in.
1 to 3	4 x 4
3 to 6	4 x 6
6 to 8	6 x 6

"The number of horizontal strut braces, either screw jacks or timbers, required for each pair of vertical braces shall be determined by the number of zones of 4 ft. each into which the depth of trench may be divided. One horizontal brace shall be required for each of these zones. Trenches, the depth of which cannot be divided equally into these standard zones, shall have an extra horizontal brace supplied for the short remaining zone if such zone is greater in length than one-half the 4-ft. unit. In no case, however, shall horizontal braces be spaced greater than 5 ft. center to center.

Bracing Must Proceed with Excavation

"The bracing and shoring of trenches must be carried along with the excavation, and must in no case be omitted, except that where a mechanical digger is used the shoring shall be placed to within 10 ft. of the lower end of the boom. Stringers shall be not less in strength than 2 x 6-in. clear timber."

The orders also provide for "adequate" sheeting in saturated ground, that excavated material may not be placed within 1 ft. of the edge of the trench and that in all trenches over 5 ft. deep suitable ladders shall be provided every 200 ft. or less.

Travel on Main Highway Increases

It is a difficult thing to determine what type of construction should be adopted for the improvement of some main highways. If by any chance they become parts of through routes for motorists, the travel over them will increase enormously and a more expensive road will be needed than if they are used only as main market roads. The American Highway Association cites the following figures to support this statement: When the Massachusetts Highway Commission began in 1909 to investigate the travel on the shore road from Boston to the White Mountains, they found that at Rowley this travel was made up of an average of 97 automobiles and 199 other vehicles a day, while in 1915 it had increased to 650 automobiles and 109 other vehicles. On an old turnpike from Boston to Newburyport the average number of users of the road in 1909 at a point 20 miles from the former city was 11, of which 4 were automobiles. In 1915 there were 341 automobiles and 6 teams using the road daily. On the old Mohawk Trail in 1912 there were 23 teams and 7 automobiles passing Florida Mountain, while in 1915, when many parts of the route were still merely dirt roads, there were 266 automobiles and 21 teams passing daily, on an average. On the Sunday before Labor Day of that year 3268 automobiles passed over the mountain.

Concrete Contractor Can Use Labor-Saving Plant to Cut Cost

Uncertain Labor Conditions Make Profitable Installations Costing 35 to 42 Cents per Cubic Yard to Erect and Dismantle

By W. P. ANDERSON
President, Ferro-Concrete Construction Company, Cincinnati

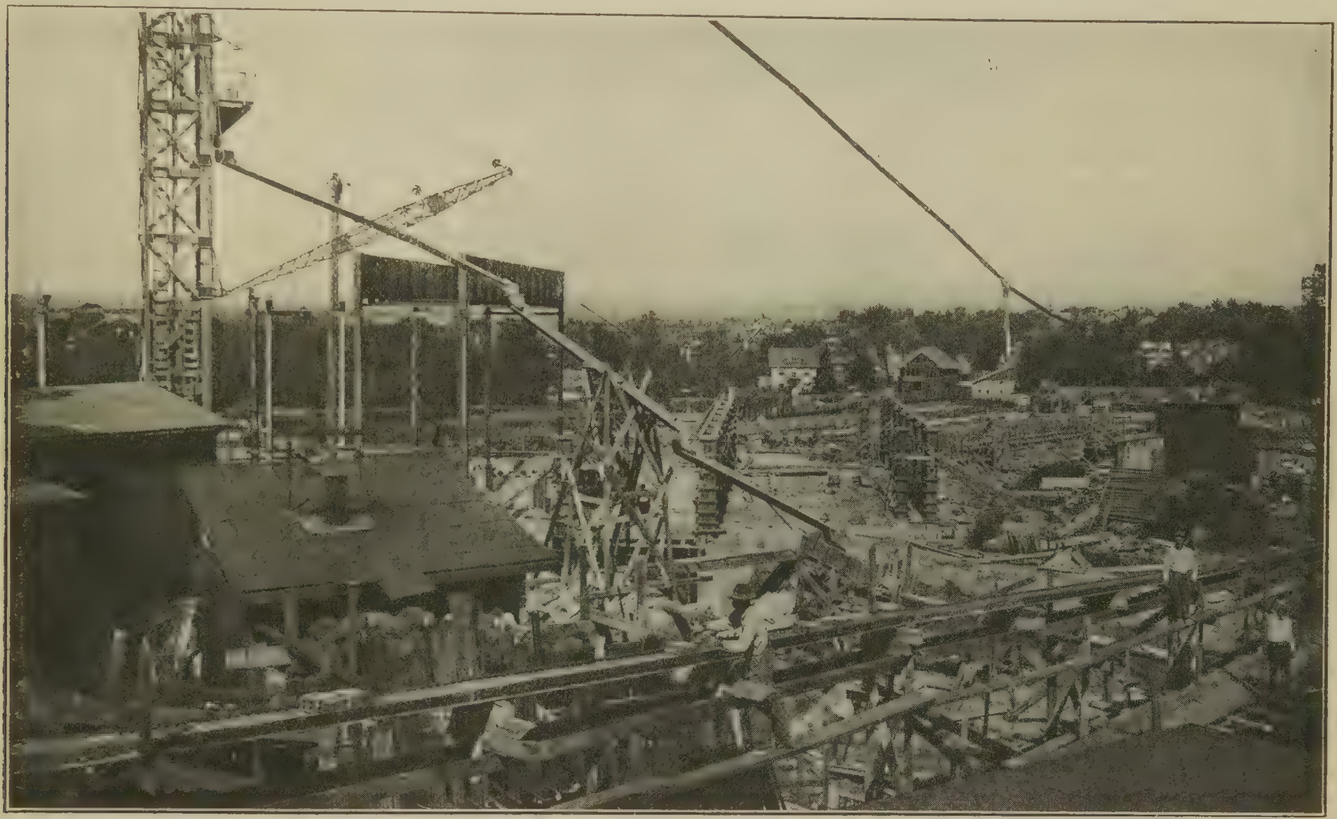
LABOR CONDITIONS during the last year have made it profitable for contractors engaged in building reinforced-concrete structures to make the fullest possible use of labor-saving equipment. The extent to which mechanical equipment for handling materials is proving profitable in such building work is well brought out by two contracts, one recently finished and the other nearing completion, carried out in Cincinnati during the last season by the Ferro-Concrete Construction Company. The concrete plants on the contracts, one of which was for a group of buildings for the East Side High School and the other for a mill and warehouse for the Ubiko Milling Company, were illustrated, together with a number of other concrete plant layouts, on page 199 of the Engineering Record of Aug. 12 last.

Number of Laborers Reduced

The object of these two installations was, as stated, to reduce the number of common laborers required by doing away with all hand shoveling, charging the mixers by gravity and decreasing the amount of labor needed in handling the chutes used to place concrete directly in the forms. At the plant of the Ubiko Milling Company this was accomplished by dumping the cars of concrete materials into a small bin under the track, from which a bucket elevator carried them to overhead storage bins feeding the mixer by gravity. Both sand and gravel were dumped into the track pit, the material being deflected at the top of the elevator into the sand or gravel compartment of the bins, as the case might be, by a gate between the bins.

On the completion of this contract the same plant was adapted to truck delivery of materials on the French-Bauer Building by providing a pit, covered with a grating in the street, through which material was dumped from wagons.

At the East Side High School the concrete materials were unloaded from railway cars to overhead bins or into reserve storage piles by a derrick with a clamshell bucket. Stone and sand were drawn from the bins into a small measuring car with two marked compartments which ran along an elevated track in front of the bins and dumped directly into the charging hopper of the mixer. The cement at this plant was unloaded and handled on gravity rollers, and the form lumber, tile and other materials were unloaded in the same way.


DROP CHUTE AND TWO SPOUT LINES FROM ONE TOWER SAVE RIGGING—GRAVITY UNLOADERS CUT HANDLING COSTS

Movable Hoppers on Concrete Towers

At both plants the concrete, after being mixed, was hoisted to movable hoppers, which could be set at any desired height on the tower, and thus spouted to place. The main tower at the East Side High School plant was provided with two hoppers so that concrete could be spouted alternately for long and short distances without materially changing the rigging of the chutes. The amount of rigging required at this plant was further reduced by having drop chutes set in the main chute lines at convenient points. At both plants, the first length of chute and the upper end of the second length were supported from split booms. The upper chute line for the high-

Labor Cost of Concreting

	—Ubiko Plant—		
	Mill	Warehouse	East Side High School
Installing and wrecking equipment	$0.426	$0.426	$0.350
Unloading sand, cement and gravel	.265	.265	.171
Mixing concrete	.272	.204	.263
Hoisting and placing concrete and handling chutes	.340	.356	.475
Cleaning up, care of sacks, and miscellaneous	.176	.140	.040
Protection on account of winter work	.003	....	....
Labor cost per cubic yard	1.482	1.391	1.299
Total yardage	2267	907	*4661

* Partial yardage; work not yet completed.

school buildings, however, which remained fixed during most of the work, was hung from a guy cable between the main tower and a centrally located tail tower. For supporting the lengths of chute within the lines of the buildings, tripods mounted on iron wheels about 30 in. in diameter were used. The large diameter of these wheels made it possible to roll the chutes around over reinforcing steel already in place, or on the forms or finished surface, with little labor. In addition to the wheeled towers a low "bicycle" frame on two similar wheels was used to carry the delivery end of the chute line at the Ubiko plant.

WHEELED TOWER FIGURES IN SUPPORT OF CHUTE LINE

The labor costs given in the table were realized with common labor at 25 to 30 cents per hour on the Ubiko job, most of the men receiving the lower rate, and at an average of 28.5 cents per hour on the high-school job. The yardage indicated in the table so far placed at the high-school job is considerably below the total quantity of concrete required; but as the total yardage has been considered in estimating the cost for installing and wrecking the equipment and for cleaning up and miscellaneous work, it is expected that the unit figures given will prove approximately correct at the close of the work. It is interesting to note that with the higher unit cost for installation on the smaller contract a lower cost for mixing and placing concrete was realized. The figures make it appear also that the grab-bucket rig has a considerable advantage over the bucket conveyor. It must be considered, however, that it was not always possible to secure materials in bottom-dump cars. Moreover, the design of the conveyor in this plant proved faulty, and a heavier one is now in use on the second contract.

It is believed that if buggies had been employed in distributing the concrete and hand shoveling had been required in unloading materials or supplying the mixers, the total unit labor cost, in spite of a possible reduction in the item for installation, would have been so much greater as to overbalance the saving on interest and depreciation charges that might have been realized by using less plant. Moreover, it would probably have been impossible to secure sufficient labor to carry on either of these contracts at the speed actually attained, which would have increased the overhead cost of the work.

Reclamation Engineers Determine Friction of Bronze on Bronze

Tests Made Under High Pressures at Pathfinder, Arrowrock and Elephant Butte Dams Give Needed Data for Gate Designs

RESULTS of experiments to determine the coefficient of bronze on bronze required under high pressures in the operating mechanisms for large, high-pressure sluice gates are given in the January *Reclamation Record.* Slide gates at the Pathfinder, Arrowrock and Elephant Butte dams were tested. These gates are provided with cast-bronze bearing surfaces of the following chemical composition: Gate leaves, 82.8 per cent copper, 8 per cent lead, 4.4 per cent tin and 4.8 per cent zinc. The gate seats are composed of 82.7 per cent copper, 4.9 per cent lead, 5.3 per cent tin and 7.1 per cent zinc.

The gates are operated by oil pressure on pistons moving in cylinders mounted on the gate bodies. In making the tests pressure gages were placed at the top and bottom of these cylinders, and the operating force was determined from reading these gages. Internal friction of moving apparatus was approximated by the oil pressure necessary to move the gate near its wide-open position. The weight of moving parts was known and allowed for. The gates were moved so slowly that no correction for momentum was needed.

PRESSURES AND FRICTIONAL RESISTANCES

Pressures were observed and frictional resistances were determined for the gates in various positions from closure to full open. With few exceptions, smaller friction factors were found with the gates partly open. This was probably due to vibration in the gate leaf, and the results obtained were apparently not reliable except for the position near closure. The results obtained in tests on two gates at Pathfinder, five at Arrowrock, and two at Elephant Butte, all in practically closed position, are as follows:

Item	Pathfinder	Arrowrock	Elephant Butte
Size of gates (larger dimension vertical), feet	4.42x7.5	5x5	3.92x5
Head on center of gates, feet	127	48.5 to 54.8	107.3
Average time of opening, minutes	16	10	5.2
Average time of closing, minutes	14	11	4.2
Friction coefficient:			
Average for opening stroke	0.42	0.31	0.336
Maximum for opening stroke	0.44	0.42	0.383
Average for closing stroke	0.29	0.29	0.254
Maximum for closing stroke	0.31	0.34	0.268

The gates tested had been operated previous to the experiment at intervals of not over two months.

Resurface Water-Bound Macadam with Asphalt Macadam

For 37 Cents a Square Yard Four-Year-Old Raveled Road 7400 Square Yards in Area Was Brought Back to Good Condition

A NEW SURFACE of asphalt macadam and an increase in width of from 9 ft. to 13 ft. were applied this past season to the Fenton Road leading out of Flint, Mich., at a cost of 37 cents per square yard. The original road was 6 to 8 in. thick, built in 1912 and 1913, and was badly rutted. Many holes and depressions had developed.

The old road was first swept free of all loose material and dirt. A scarifier was then used to loosen up 2 ft. of dirt and gravel berm at both sides of the 9-ft. macadam roadway. The space was then cleaned out to a depth of about 4 in., and crushed stone ranging from 2 to 1 in. in size was placed and rolled to the grade of the old macadam. All depressions over 2 in. in depth were brought to grade with crushed stone, and the road was then thoroughly rolled to its full width. Over this surface was spread crushed limestone ranging in size from 2¼ to 1 in. This course was rolled with a 10-ton Port Huron roller. Stanolind paving asphalt at 110 penetration was then applied at the rate of 1½ gal. to the square yard, at a temperature of 300 deg. Fahr., under 40 lb. of air pressure from a tank wagon equipped with an air compressor and a large firebox.

COMPRESSOR DRIVEN WITH STEAM FROM ROLLER

The air compressor was driven with steam from the roller used to pull the tank wagon. Immediately following the application of the asphalt the key or binder stone was spread at the rate of 60 sq. yd. to the cubic yard, the limestone ranging from ¾ to ⅜ in. in size. This was then rolled with a 10-ton roller and the loose stone swept off. Following this, ½ gal. of asphalt to the square yard was applied, after which stone chips ranging in size from ⅜ to ⅛ in. were spread over the surface at the rate of 80 sq. yd. to the cubic yard. The road was finally thoroughly rolled with a 10-ton roller and opened to traffic.

In two weeks' time the traffic showed that it was properly drawing the asphaltic cement to the surface, and in four months' time an asphalt mat had formed over the entire surface, completing a bituminous wearing surface firmly cemented to the old road. The yardage amounted to 7400 sq. yd.

SPREADING STONE AT THE SIDES AND IN LOW PLACES

TWO MEN SPRAY HALF GALLON ONTO THE "KEYSTONE" LAYER

The work was done by the county commissioners of Genesee County, Mich., under the direction of C. C. Lakin, a representative of the Standard Oil Company of Indiana.

Higher Salaries Needed for Geodetic Survey Engineers

Frequent Resignations Reduce Efficiency of the Department—Leave Service for Better Compensation Elsewhere

OUT of a total of 118 engineers employed by the U. S. Coast and Geodetic Survey, 62 have had less than 6½ years of service and 43 have been with the Survey less than 3¼ years. Aside from the inefficiency in costs of having inexperienced officers, vessels carrying millions of dollars' worth of cargo are being subjected to the gravest risks, says the superintendent of the U. S. Coast and Geodetic Survey in his annual report.

What is necessary to make for greater efficiency, continues the report, is to pay salaries more nearly like those paid for similar or less exacting duties in other government services and in private engineering fields. During the six years following November, 1909, 66 out of 99 field officers of the Survey resigned, nearly all of them to take up work paying higher salaries or promising increases in the near future. A few objected to the hardships of the field work.

During the last seven years and until July 1, 1916, every man whose name was placed on the aid register by the Civil Service Commission was offered a position in the Survey. This, according to the report, is an unhealthy condition of affairs, as there should be so many names on the register that the appointing officers may always have a choice of at least three eligibles. The increases in the number of positions called for in the 1918 estimates are distributed in such a way as to make the salary list more attractive to those now in the service, and to engineering graduates.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Camera on Engineering Work

SIR: I have noted with satisfaction the discussion in your recent issues on the use of the camera in engineering work. The Dominion Water Power Branch, Interior Department, Ottawa, with which I am connected, has always insisted on reports from field officers being fully supplemented by satisfactory photographs, and has given special attention to having all photographs, including the negatives, properly filed. This has stimulated whatever personal interest one may have had in such work.

I believe it is now generally recognized that a camera is as essential in an engineer's field equipment as any other instrument, and warrants the same careful manipulation. The best type of camera is, however, not so easily settled. I heartily agree with Mr. Johnson's objection to lugging around a camera which will not go in one's pocket, and personally have found a camera of the size he suggests—one giving a picture 2¼ in. square—most satisfactory for ordinary work. After using a camera of this size fitted with a lens of F7.7 aperture, I am of the opinion that a more expensive lens is not essential. Such a camera, fitted with one of the newer and moderately expensive anastigmats, is inexpensive in its first cost and in its operation, and at the same time offers all the advantages of convenience and of the possibility of enlargement to any reasonable size. In fact, I have found that with the lens mentioned considerable enlargement is necessary before all the detail in the negative is properly brought out.

On the other hand, a larger camera, up to 5 x 7 in. at any rate, can be used to good advantage on construction work, particularly where the camera need not be carried long distances, and where details are particularly valuable. It goes without saying that this camera should be fitted with the best possible lens, in which case it may be used to great advantage in reproducing large drawings at a convenient size. For some time I used on construction a 5 x 7-in. camera fitted with a first-class lens that gave results which would have been impossible with a smaller camera.

I am an ardent advocate of the small camera, preferably 2¼ in. square, fitted with a moderately good lens for general use, but also believe that, where possible, resident engineers and superintendents should be equipped with a larger camera, preferably of the reflecting type, and fitted with the best possible lens.

I cannot refrain from adding a word as to the excellent and useful results which may be obtained from the panorama camera. I obtained a large number of excellent negatives 3¼ x 12 in. with a camera that originally cost only $20, and from these negatives secured perfect enlargements up to 3 ft. in length.

It seems to me that in a great many cases ultra-expensive lenses are not warranted, and that, on the whole, better results are to be obtained by emphasizing the need for more careful manipulation of the moderately priced camera than by urging the necessity for high-priced equipment. I have in mind one particular example of this kind, where an assistant had a comparatively cheap camera which he claimed was no good, but who, after a little coaching, is now producing first-class pictures with this camera under all kinds of conditions.

K. H. SMITH,
Resident Engineer, Dominion Water Power Branch.
Halifax, N. S.

SIR: After reading Mr. Johnson's letter relative to the camera on engineering work and the filing of prints and negatives, in your issue of Dec. 16, 1916, page 750, I would like to suggest a method of filing which I have used for the last four years.

On the glossy side of a film negative, with black drawing ink put, for instance, the number 160923c. The first two digits stand for the year, the middle two for the month and the last for the day, the letter c (third letter in the alphabet) meaning the third picture taken that day. No letter need be used if only one picture is taken on any one day. In printing, this number is transferred to the picture.

Besides having a number by which to file and index your pictures and negatives, the date of the picture, which is the impossible thing to remember about any picture, is incorporated in the number. If the negatives for each month or year are kept in envelopes, with numbers running consecutively and the envelopes marked accordingly, any negative is very readily found from the picture.

This method of numbering is also applicable to the numbering and filing of jobs, drawings, etc.

Ann Arbor, Mich. W. BINTZ.

Water the Chief Factor in the Making of Good Concrete

SIR: The article "Water the Chief Factor in the Making of Good Concrete," by Nathan C. Johnson in the Engineering Record of Dec. 30, 1916, page 790, was read with considerable interest. The writer thoroughly agrees with all that he has said, and believes that "we face a revolution in our knowledge of the factors that go to make concrete."

In 1910 and 1911 the writer had charge of the construction of two large double-track bridges near Necedah, Wis. The concrete in this work amounted to approximately 10,500 cu. yd. Early in the construction of these bridges the laitance and "day's-work seams" became troublesome. A day's run did not complete the footing in one of the abutments, and the next morning the top of the concrete was covered with from ¼ to ½ in. of slippery, clay-like material which was thought to be clay and stone dust from the crushed limestone. This was removed and the surface of the concrete thoroughly scrubbed before continuing the work. The stone was selected with care, keeping out the clay and stone dust. The deposit was found as before. This was also removed before concreting was continued.

It was found difficult to get the concrete mixed so that we would not have excess water in the form. All materials and water were measured for each batch of concrete, but still we had trouble at times with excess water. It was finally decided that the amount of water should vary according to the judgment of the inspector, so the excess water in the form was not so troublesome and a more even mix was obtained. The concrete when dumped into the form was plastic, and the laborer, while spading in the form, would sink into it from 5 to 8 in. Excess water would occasionally accumulate in the form. This water was pushed to one end by dumping the concrete continuously from one end of the form, and at first was removed with a bucket, but later a ¾-in. hole was made in the form just above the concrete, so it could run out on the ground.

It was thought that considerable cement was lost by letting the water out in this way, but a study of this revealed the fact that but little cement was wasted, although practically all of the laitance did pass off with the water. It was noticed that the amount of laitance seemed to vary in the different shipments of the same brand of cement, also a less amount of laitance was found if the concrete did not have an excess of water. In fact, excess water invariably caused laitance seams if it was not removed from the surface of the concrete within a short time after the concrete began to take its initial set. The concrete work on the two structures was watched carefully, and the results show few if any "day's-work seams."

The writer remembers when the contractor was not allowed to tip a bucket of concrete, dropping it 6 ft. into the footing of a large abutment, but was required to use open-bottom buckets and lower the bucket near the surface of the concrete before dumping, for fear of separating the mix and sending the coarser material to the bottom. Contractors are now allowed, in almost all concrete construction work, to erect a centrally located tower where the concrete is taken from the mixer and elevated to a height necessary to chute it several hundred feet into the forms, making a very wet mix in order to deliver it without difficulty. In fact, they are allowed to do almost what they please with the concrete, just so long as they get it in place and the outer face looks smooth when the form is removed.

It has been my observation that the best concrete is mixed to a plastic consistency (which requires the amount of water to vary from time to time as the conditions of the materials and the weather may demand for a mix of this kind) and deposited into the form without breaking up the initial mix, after which it is worked into position around the reinforcing with a churning motion, thus bringing excess water to the surface, where it can be allowed to accumulate at one end of the form and removed before the concrete takes its initial set.

J. S. MORRISON,
District Engineer, Iowa State Highway Commission.
Ottumwa.

SIR: Probably all engineers will admit the injurious effect of using too much water in concrete even though this effect is not fully recognized in practical work. The first four paragraphs of Mr. Johnson's proposed specifications will be accepted readily by the majority of engineers. His fifth clause, proposing to waste the lighter portions of the concrete, is equivalent to an admission that these troubles cannot be avoided by proper inspection, and does not strike at the root of the evil.

The responsibility for defective work such as Mr. Johnson describes rests primarily with the engineer in charge. If he permits the contract to be let without consideration of the methods to be used, especially the use of chutes with flat slopes, the inspector, no matter how competent, cannot control the water properly. If steep slopes are insisted upon by the engineer and a suitable proportion of mortar is provided in the mixture, excess water is not required, and no laitance or separation of liquid mortar need occur unless the inspector is careless or ignorant. It is futile to try to correct these abuses by wasting good material as Mr. Johnson proposes.

In building a large dam in Spain (Talarn dam, 270 ft. high above bedrock, 355,000 cu. yd. in dam proper) it was necessary to prove to a specially appointed commission of government engineers that the methods used, which followed good American practice in many respects, were sound and permissible in such a structure. As a result, careful investigations were made covering a very broad field and extending over a number of years. These tests, among other details, confirmed once more the fact that the best results are obtained with a reasonably plastic but not liquid mixture, and that any reduction of the slope of the chutes beyond 1¾:1 or 2:1 retards the hardening and causes a permanent diminution of strength, which becomes very considerable with the slopes often used to-day in concrete work in the United States.

Nevertheless, it was also shown that the surplus mortar which separates under certain conditions is often nearly as strong as the concrete itself. In one case at the beginning of the work, variations in the grading and the consequent use of too much water caused marked separation of the surplus mortar, but the final compressive strengths of the liquid mortar on the surface near the forms, of the nonplastic concrete under the chute and of the rather liquid concrete lying between were 3410, 4415 and 4170 lb. per square inch respectively, as compared with the minimum requirement of 2135 and the maximum calculated stress of 285 lb. per square inch. Evidently in this special case wasting this surplus mortar would have been wholly unnecessary, and this is true in many other cases where the excess of water used is not too great.

Laitance is of course extremely objectionable, but it occurs only under lax inspection and can instantly be distinguished from mortar by the appearance and feel. Its appearance in finished work proves carelessness on the part of the inspector.

The point which should be emphasized is this, that the engineer in responsible charge of construction work is primarily responsible for bad concrete. Any contractor, if allowed to do so, will use flat slopes and an excessive amount of water, as it is cheaper to place concrete which is excessively wet than that which is reasonably plastic but not liquid. It is important that the requirements in this matter should be fully understood at the time of placing the contract. When the purchaser's engineer is ready to pay for proper methods and insists upon their use, the tendency to use an excessive amount of water will disappear at once. In the meantime any proposal to waste the surplus liquid mortar fails to insure good work, much less to remedy the evil.

A. W. K. BILLINGS,
Consulting Engineer.
New York City.

SIR: The article entitled "Water the Chief Factor in the Making of Good Concrete" is in the opinion of the writer timely, interesting and important. He would, however, take exception to the suggested specification, item No. 5, which says, ". . . the top portion of the forms shall be removed throughout the entire length of the section to such depth as may be required by the engineer and . . ."

If the depth to which the forms are to be removed is limited to a few inches, the forms could be constructed so that the above specification could be complied with and not be seriously expensive. If, on the other hand, this depth varied, it would be rather a burdensome operation. Assume, for instance, that the forms are made of 10-in. plank laid horizontally, and the engineer directs that 4 in. of the top be removed.

It seems to the writer that the purpose of this suggestion can best be accomplished by providing for the continuous pouring of the concrete from the bottom to the top of the section. Of course this is not possible in all cases, but it is possible in many cases where it is not done.

W. C. BRIGGS,
Civil Engineer.
Brooklyn.

SIR: The writer has read with a great deal of interest Mr. Johnson's article and desires to call to your attention his article as published in the *Engineering News*, May 22, 1913, on the effect of too much water in mixing concrete.

Mr. Johnson is absolutely right in stating that water is the chief factor in the making of good concrete. In most instances the method of placing the concrete necessitates the use of a sloppy or watery mix. One of the arguments of the contractor is that even if the concrete contains more water than necessary, nevertheless the factor of safety is great enough to give satisfactory results.

In order to secure an ideal mix of concrete, it is absolutely necessary that it shall be tamped. On many of the small jobs it is impossible to be strict with the specifications, because the expense of living up to them is too great. The percentage of water entering into a mix of concrete varies according to the character of crushed stone used. Furthermore, the temperature of the atmosphere is also an important factor in the percentage of water. A concrete mix might contain a larger percentage of water than necessary, and unless it is tamped it is not noticeable. The best way to overcome the placing of too much water in concrete is to require that all concrete be tamped. This permits a drier mix to be used, and the engineer can regulate the percentage of water by observation and eliminate the expense of constant measuring and fluctuation of the measurement due to atmospheric and other conditions.

In regard to the removing of laitance, this should, under all circumstances, be done while the surface is setting. After concrete is once set it is impossible for laitance to be satisfactorily removed.

One of the best methods of eliminating the evils of poor concrete would be to have competent inspectors on the job—men who understand concrete not only from a practical but also from a theoretical standpoint, and also to carry on an educational campaign among the contractors, explaining to them that it is to their advantage to place the concrete properly.

Canton, Ohio. CHARLES J. ROBISON, C.E.

Motor-Truck Legislation

SIR: In reading over the article on "Rules Proposed to Control Motor Trucks in New Jersey" and your editorial of Oct. 28 on the same matter, it would seem that these rules are along the right lines. Perhaps some changes in some of the requirements in the proposed rules should be made.

One thing is certain: Some rules and regulations must be made if we are to preserve our streets and roads and make them of lasting value to commerce. Two questions are involved: First, shall we regulate the traffic to our roads as constructed, or, second, shall we regulate our roads to the present traffic and for future traffic?

Taking up the first phase of the questions, we have the fact that there are thousands of miles of paved streets or roads now constructed. If traffic greater than these pavements will stand should be allowed, the present pavements would have to be replaced with others strong enough to carry the increased traffic and loads—and at an expenditure of millions of dollars. On the other hand, if the traffic were regulated to the better class of pavements now constructed it would reduce the size of the load which might be transported in the first case, but by placing the load on eight or twelve wheels instead of four the same amount of tonnage could be carried without damage to the road surfaces. In other words, the bulk of the tonnage could be carried in trailers.

It is estimated that an auto truck can pull four times as much as the load on the truck, so that there would be an advantage in the use of trailers. The destructive effect on the pavements is much less in the rolling load in the trailer than the tractive force in the truck.

The limitation as to the load per inch of tire in connection with the size of wheel and speed seems to be reasonable. It does not seem, however, to be so necessary to limit the length of the vehicle as it is to limit the width. The length does not affect the pavement particularly, but the width does limit and reduce the amount of traffic a specified width of pavement can accommodate; and if a vehicle uses more than, say, 84 in. in width, it is encroaching upon another vehicle's right and should pay for it.

There is one class of traffic that will have to pass over the pavements of the Northwest in particular, and that is traction engines and similar machinery. Most of these machines are equipped with grouters, lugs, or bars to prevent slipping in soft soil. These are not detachable in most cases. These conditions would seem to necessitate the construction of a type of pavement not easily affected by this class of wheel traffic; otherwise some temporary covering must be placed over the projection on the wheels to prevent damage.

From a careful study of the whole question it would seem wiser, more economical and better to regulate the traffic to the better class of pavements as now constructed.

ELLIS R. DUTTON,
Minneapolis, Minn. Assistant City Engineer.

SIR: I have read with much interest the articles in the Engineering Record on "How Shall Motor Trucks Be Regulated to Conserve Highways?" I believe this is one of the subjects of greatest importance to highway officials. That we may take advantage of cheaper transportation, on the one hand, provisions must be made for motor-truck transportation. On the other hand, that there may not be an economic waste in the use and abuse of our present highways, some restrictions must be placed upon their operation. The exact nature of these restrictions must be the result of a compromise because of the many and various conditions influencing them.

That we may not retard or curb too much what will be a more economic development of our transportation facilities, much study and consideration must be given to the restrictions placed on this kind of transportation. With reference to this phase of the subject I am of the opinion that Rule 8 of the proposed New Jersey Rules and Regulations (see Engineering Record of Oct. 28, 1916, page 536), forbidding the use of but one trailer, should have some modification; also that the rubber-tire provision of the trailer is unwarranted.

The provision of Article V, requiring sealed governors on all commercial vehicles, is of doubtful justification. If it is necessary on commercial vehicles, why not on passenger vehicles? It would seem that there are more good reasons for making this provision apply to passenger vehicles than to commercial vehicles. In the former case it would also be a protection to human life—a "safety-first" provision, so to speak—while in the latter it would be mostly a commercial question. This is a very delicate subject, and I question very much the practicability of the universal enforcement of such a restriction.

The proposed provision in the New Jersey rules (Article V) for a graded license fee is a commendable one. Of all the complicated questions involved in determining a just tax it would seem that this is one of the most exact means of placing a tax in proportion to the service rendered. We can, to a very decided degree, take care of the economic question involved in the restrictions by the proper application of the graded fee. It might be made much more flexible than to apply just to a variable load.

Inclosed I am sending you a copy of the rules and regulations adopted by the Ohio State Highway Department about a year ago. These may be of some interest to you, although some of them are not up to date because we had to adopt such as had been previously enacted into laws, perhaps so long ago that they are antiquated.

A. H. HINKLE,
Deputy Highway Commissioner, Bureau of Maintenance and Repair.
Columbus, Ohio.

[Some of the provisions in the Ohio rules are as follows: Lugs, spikes, chains or other projections seriously destructive to the surface are prohibited. Twelve feet wide is the limit "unless said greater width will leave one-half the road free for passing vehicles." A maximum load of 3400 lb., including the weight of the vehicle, shall be carried over a gravel, macadam or stone road in a vehicle having a tire less than 3 in. wide. For wider tire widths the linear-inch load shall not exceed 600 lb. This is halved where the road is soft because of thawing weather or excessive rains. Trailers must track with the pulling vehicle. Written permission from the state highway commissioner must be obtained to move loads in excess of 15 tons. Speeds for motors carrying in excess of 4 tons, including the vehicle, shall not be greater than 15 miles per hour, and in excess of 8 tons, 6 miles for metal-tired vehicles and 12 miles for rubber or similar substance.—EDITOR.]

Standard Ottawa Sand Not Strong Enough for All Purposes

SIR: I wish to call attention to a misconception some engineers appear to have regarding standard Ottawa sand. The specifications of the American Society for Testing Materials require a natural sand from Ottawa, Ill., screened to pass a No. 20 and be retained on a No. 30 screen, and therefore, on account of its grading, it will give a relatively weak mortar or concrete with the usual proportions. In spite of this a great number of specifications require a sand developing a strength of only 75 or 100 per cent of that of standard Ottawa sand, and the writer remembers one instance, on reinforced-concrete work, where only 50 per cent was specified.

On a contract recently let by this department a well-graded sand developing a strength of 150 per cent of that of standard Ottawa sand in 1:3 mortar was specified, and three sands accepted for this work gave an average of 167 per cent in tension and 200 per cent in compression.

In the writer's opinion, the generally accepted specifications might be improved by requiring the sand to develop a certain percentage of the strength of standard Ottawa sand without specifying the proportions, the proportion of furnishing this strength being used in determining the amount of cement to be used in the structure. The percentage required will be governed, of course, by the nature of the work in which the sand is to be used, and the contractor would benefit in saving of cement by furnishing an extra-good sand. A sand which could not furnish this strength at maximum density would, of course, be rejected. The tests for grading and composition would also be applied.

JOHN H. RYCKMAN,
Toronto, Ont. Department of Works.

Los Angeles Publishes 3000 More Copies of Aqueduct Report

The Los Angeles Department of Public Service has published 3000 copies of the final report of the construction of the Los Angeles Aqueduct to meet demands for the volume which were received after the first edition had been distributed. The charge of $1.95 prepaid is asserted to be less than the cost of production.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Pontoons Convey Concrete Used to Seal Coffer with Sand Bottom

SMALL PONTOONS were used to convey concrete buckets between the mixing plant and the tremie float in sealing the large cofferdam for government lock 1 on the Cape Fear River at Kings Bluff, N. C. Concrete seals were placed around piles on sand bottoms at this lock and at lock 2 (described in the Engineering Record of Sept. 9, 1916, page 325), which were able to withstand an upward pressure of 2000 lb. per square foot.

WITH THE COMING OF WINTER you construction men have a little time which you can call your own.

TAKE A FEW MINUTES of it to write us about that stunt you used last summer that had the "edge" on anything you'd seen before.

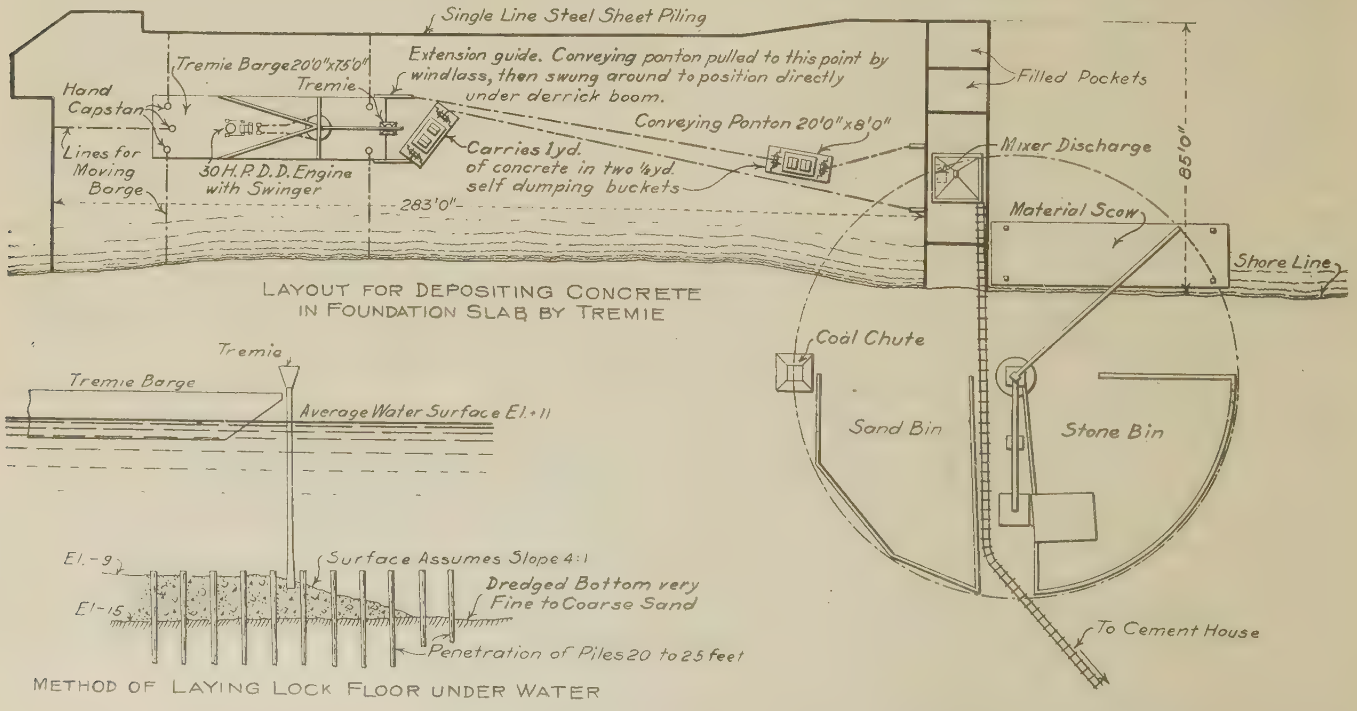
WE PAY FOR THESE ITEMS, and the many people who read them learn about you, your organization and your work.

ONLY A SHORT LETTER, with a sketch or one or two of those snapshots you took at the time, is needed. Send them to-day.

As outlined by Capt. C. S. Ridley, Corps of Engineers, U. S. Army, in *Professional Memoirs*, January-February, 1917, this type of construction, involving a steel cofferdam set close to the outlines of the completed lock and sealed with concrete, was adopted, in preference to an unsealed cofferdam of sufficient size not to be injured through movement of water and sand running into the pumped area, to avoid obstructing the narrow navigable channel of the river. With a view to depositing concrete for the seal through a tremie, the foundation piles, which cover the entire area inside each lock, were driven in rows across the cofferdam 4 ft. apart. At lock 1 the tremie barge, which mounted a derrick, used both to support the tremie and to dump the concrete buckets, was started at the upstream end facing the wall of the cofferdam. While in this position the concrete buckets were lifted from the pontoons by a small unloading derrick, set on flat cars running on a track the length of the tremie barge and carried to the derrick at the other end. As soon as concreting had progressed the length of the tremie barge, it was turned around and the large derrick alone used thereafter. The pontoons were handled from the mixer to the barge by lines wound on hand winches and rigged as shown in the sketch.

On account of the progress of the work it was necessary to place the seal at lock 1 during the winter, when high water prevailed. Therefore the concrete was deposited at depths ranging from 22 to 34 ft., and at times concreting was carried on with the cofferdam completely flooded. The tremie was made up of 12-in. diameter cylindrical sections bolted together with flanges, and was provided with a hopper at the top and a short section at the bottom flared to 15-in. diameter. Work at lock 1 was carried on 24 hours a day, with only a few short delays for repairs, in order to have the seal monolithic.

On starting, the tremie was set on the bottom and a batch of rather dry concrete with three or four sacks of cement dumped in. As the tremie tube held a little more than ½ yd. of concrete, probably only a small part even of the first batch was "washed" by dropping



LAYOUT FOR DEPOSITING CONCRETE IN FOUNDATION SLAB BY TREMIE

METHOD OF LAYING LOCK FLOOR UNDER WATER

Single Line Steel Sheet Piling
Tremie Barge 20'0"x75'0"
Tremie
Extension guide. Conveying ponton pulled to this point by windlass, then swung around to position directly under derrick boom.
Hand Capstan
Lines for Moving Barge
30 H.P. D.D. Engine with Swinger
Carries 1 yd. of concrete in two ½ yd. self dumping buckets
Conveying Ponton 20'0"x8'0"
283'0"
Filled Pockets
Mixer Discharge
85'0"
Material Scow
Shore Line
Coal Chute
Sand Bin
Stone Bin
To Cement House
Tremie
Tremie Barge
Average Water Surface El. +11
El. -9
El -15
Surface Assumes Slope 4:1
Dredged Bottom very Fine to Coarse Sand
Penetration of Piles 20 to 25 feet

SMALL FLOATS, EACH HOLDING TWO CONCRETE BUCKETS, PULLED BY WINCH LINES BETWEEN MIXER AND TREMIE FLOAT through water. After charging the tremie the concrete was kept in sight near the top of the tube. As each batch was dumped it filled the ½-yd. hopper at the top. The tremie would then be shifted along the front edge of the boat by swinging the boom, allowing the concrete to run out at the lower end until the hopper was empty. Movement was then stopped until the next batch was dumped in the hopper. When the tremie had been shifted the length of the front end of the barge, the barge itself was moved over by means of the lines indicated on the layout drawing. One trip across the cofferdam between each row of piles was sufficient to bring the concrete to the desired grade 6 ft. above the bottom. The concrete as deposited flattened out on a 4 to 1 slope, as shown in the section, resulting in long laps between the masses placed in succeeding rows, and avoiding undesirable vertical joints.

As the foundation piles had been driven a considerable distance below water with a follower, a few of them were found out of line; and occasionally in dragging the tremie across the cofferdam it would strike a pair of piles too close together to let it pass and be lifted off the bottom and lose its charge. This, however, produced no serious defects in the seal at either lock.

On account of the high water which prevailed during and after the concreting of the seals—it being impossible to pump the cofferdam at lock 1 for two months after the seal was finished—a layer of mud and scale was found on top of the concrete upon unwatering. When this was removed, however, the main body of the concrete was found to be in excellent condition. The slab proved practically watertight, but the pressure on it was sufficient to force water through the grain of the pine piles projecting above the concrete, so that the heads of these piles oozed water. The maximum pressure of 2000 lb. per square inch would be developed by a head of 32 ft. on the bottom of the seal with the coffer pumped dry. Of this pressure, about 900 lb. would be balanced by the weight of the concrete, leaving an upward pull of about 6½ tons on each pile. As a matter of fact, the seal at lock 2 successfully withstood a head of 30 ft., although as actually placed it varied from 1 to 2 ft. thinner than that at lock 1.

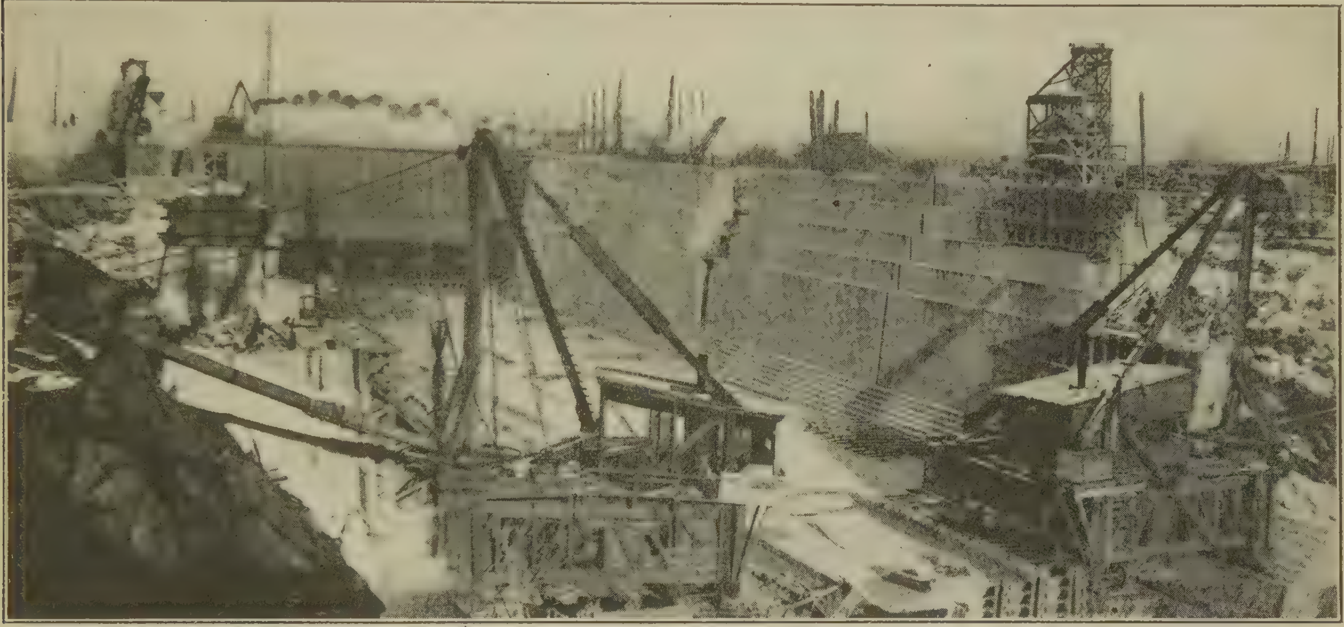
Construction on the Cape Fear River project has been carried on by government forces under the direction of Capt. C. S. Ridley, Corps of Engineers, U. S. Army.

Seat Gate Before Completion of Quebec Drydock to Reduce Pumping

By H. H. BRAUN

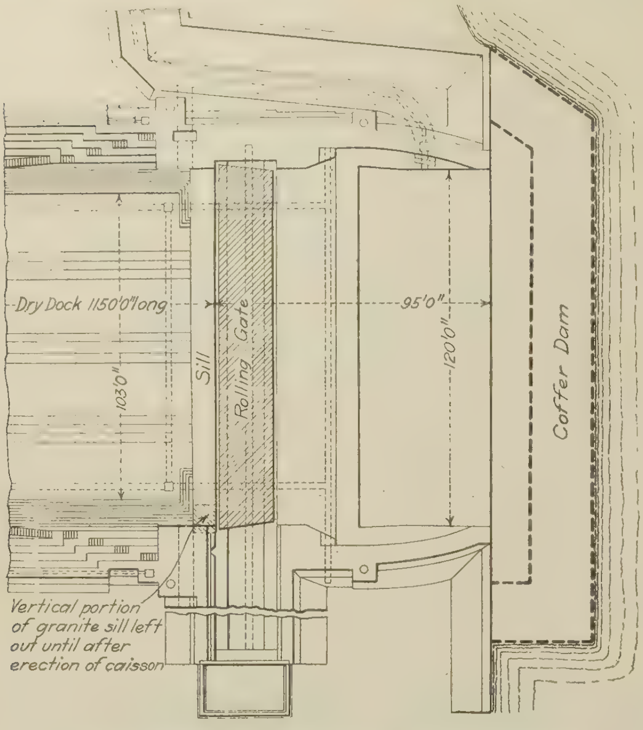
General Superintendent, M. P. & J. T. Davis, Quebec

ON NOVEMBER 18 the cofferdam at the outer end of the government drydock under construction at Quebec was flooded to reduce pumping charges, the steel caisson gate across the outer end of the drydock having been erected and closed. The gate was moved 1⅛ in. sidewise into place by the pressure of the water on its outer side.



PUMPING GREATLY REDUCED FOR LARGE PART OF CONSTRUCTION BY CLOSING GATE AND FLOODING OUTER COFFER

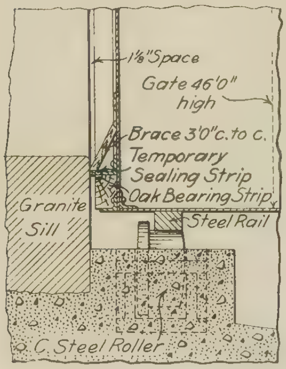
As shown in the sketches, this gate is 122 ft. long and 19 ft. 3 in. wide. It weighs, with ballast, 1500 tons. An oak bearing strip around the inside edges makes a watertight joint with granite sills in the bottom and the sides of the dock. This sill was first laid across the bottom and up one side of the dock in a recess left in the concrete. The caisson gate was then erected on its rollers, 6 ft. from its closed position and 1⅛ in. back from contact with the sill. The oak strip across the bottom of the caisson was placed at the beginning of erection, and that up one side after completion. In order to provide space for placing the strip on the other end, it was necessary to leave out the sill at that side of the dock. After the erection work was finished, the caisson was jacked endwise into closed position and the strip on this end placed. With the 1⅛-in. clearance provided it was then possible to lay up the granite sill on this end, leaving the end of the dock closed except for the small distance by which the gate was out of contact with the sill. This work was completed considerably in advance of the construction


Dry Dock 1150'0" long
95'0"
120'0"
103'0"
Sill
Rolling Gate
Coffer Dam
Vertical portion of granite sill left out until after erection of caisson

GATE ERECTED SIX FEET FROM CLOSED POSITION

inside the dock proper, so that the cofferdam could be dispensed with and the pumping charges practically eliminated for a good portion of the work.

While the gate was of course designed to move endwise, it was not intended to be moved sidewise, and the problem presented of overcoming the friction due to its 1500 ton weight in sliding it over on the rollers to contact with the sill was a serious one. It was decided not to attempt to move the gate by mechanical means, but to trust to the head of water on the outside to push it into contact after the cofferdam had been flooded. To prevent a large flow of water into the dock before the gate should move over, a soft pine sealing strip was inserted between the bearing strip and the granite sill and braced down as shown in the sketch. Care was taken to see that nothing got between the faces of the sill and the bearing strip. When the sluice gates in the cofferdam were opened and the space outside the gate filled to a considerable depth, the water pressure crushed the temporary ceiling strip and moved the gate over into contact. It was expected that when the water reached a sufficient height the gate would go over with a bump. This did not occur, however. The movement was very gradual, and almost no water passed the temporary sealing strip during the process.



SEALING STRIP KEPT OUT WATER

The drydock is being built for the Canadian government by M. P. & J. T. Davis, contractors, of Quebec, under the general direction of S. H. Woodard. The writer is in charge of construction as general superintendent. The caisson gate was built by the Dominion Bridge Company as subcontractor.

Battered Tops Cut Off Long Steel Sheet Piles Before Pulling

THE TOPS of the arch-web steel sheet piles driven, with several makes of sheeting hammers, in the deep cofferdam for the power plant at Beach Bottom, W. Va., described on page 144 of this issue, were battered in driving. When pulling was started with a gin-pole and an eight-part set of wire-rope falls, the piles not only pulled hard all the way up, but the interlock of the pile being pulled would be so badly bent in drawing it through the battered section of the pile next to it as to make the pile useless. After three or four pieces of sheeting had been withdrawn in this way, the oxyacetylene outfit kept on the job for general use was put to work cutting off the tops of the piling. A straight cut was made all around the cofferdam, taking off the battered tops of the piles, which averaged about a foot in length. New pulling holes, one about 6 in. below the other, were burned in each pile. These holes were burned large enough to accommodate a 1½-in. pin. They are stated to have been a great improvement over the small holes usually provided. The arrangement of having one of them directly over the other also brought more of the web metal of the pile into play in pulling than was the case with two holes side by side. Where the pulling was very hard, long straps with a pin through each hole could be used, the pin which first took a strain stretching its hole slightly till the other pin came to a bearing. The plant is being built by the Foundation Company, for which H. B. Kelsey is superintendent under George R. Johnson, district manager.

Wayne County Intends to Build Wider Concrete Roads

Hereafter no concrete road in Wayne County, Michigan, will be built with a width less than 16 ft.—24 ft. including shoulders. This statement is from the annual report for 1915-16 of the board of county road commissioners headed by Edward N. Hines, chairman. Experience shows that immediately upon opening up a new concrete road traffic increases enormously as compared with what it was before. The report continues: "Not only is greater use made of the road by abutting dwellers, but people come miles from either side to use the concrete road in preference to the routes they have been accustomed to using. The roads therefore must be built, not with a view of accommodating the traffic they have been accustomed to bear, but to accommodate at least three times that traffic. Our roads attract traffic, and, with this increase, the tendency is toward greater speed, wider gage and heavier bodies, so we have decided that wherever feasible we will make the roads 18 ft. wide, of concrete, 26 ft. over all. Near Detroit we are going to increase the width to 20 ft. of concrete, 28 ft. over all." While this will add materially to the first cost, the report points out, it will prove a real economy in the end, as the cost of macadamizing and repairing the shoulders will be eliminated to a large extent. The statement is made that more money has been spent in the past few years on the shoulders of such roads as Woodward Avenue and Seven Mile Road than would have been paid for the first cost of building these thoroughfares 6 ft. wider of concrete.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Discuss Engineers' Part in Americanization

Meeting in New York City Under Auspices of Chamber of Commerce of U. S. A.

The engineers' part in Americanization—that is, the work of educating immigrants to American standards and instilling in them a love for American institutions—was discussed Jan. 19 in New York City at a dinner given by the Immigration Committee of the Chamber of Commerce of the United States of America and Mr. and Mrs. Vincent Astor at Mrs. Astor's home. In the absence of the chairman of the committee, Frank Trumbull, Gano Dunn, president of the J. G. White Engineering Corporation, presided.

Mr. Dunn, in opening the meeting, briefly stated the purpose of the discussion and explained the engineer's natural relation to Americanization work.

"Industrial Americanization is a part of the present-day movement toward the humanization of industry," he said. "It aims to make what is commonly called 'welfare work' not an exercise of the employers' paternalism but a legitimate part of business organization everywhere.

No Welfare Agreement

"There are now innumerable kinds of welfare work. But there is no agreement among American employers as to where the organization of the human side of industry really belongs. And there are absolutely no standards for it. What we need to do is to extend scientific methods to the human phases of industrial organization, and thus give welfare work a definite place and definite standards.

"The engineer, as the 'consulting mind' of industry, must be the leader in this work. It is he who determines the site of the plant and its construction. Inside the plant the engineer, again, has much to do with efficiency methods. No efficiency methods that are unrelated to the man in the plant can prosper permanently."

The various speakers, among whom were Dr. Ira N. Hollis, president of the American Society of Mechanical Engineers; Raymond B. Price, vice-president of the United States Rubber Company; Howard E. Coffin, and Michael I. Pupin, brought out the beneficial affect of cultivating the immigrant, teaching him English and showing him that America wishes to help, not to exploit him.

Dr. Hollis, speaking on behalf of the engineers, pledged their support for the movement and promised co-operation in any plans for furtherance of the work that the immigration committee might propose.

Plans for further work looking toward placing the matter more fully before engineers are not yet matured, but it is understood that the steps toward this end are to be taken shortly.

House Passes Building Bill

An omnibus public-building bill, which President Wilson is quoted as having said he would veto, was passed Jan. 19 by the House, 234 to 92. It carries $38,000,000 for buildings, improvements or sites in cities and towns all over the country. The bill now goes to the Senate.

Action in the House followed a long and bitter debate, during which advocates of the measure defended it and opponents denounced it as "pork barrel" legislation.

While the bill carries a total of $38,000,000, Chairman Clark of the Public Buildings Committee told the House that this would be reduced about $6,000,000 by money returned to the Treasury through the sales of old sites and buildings.

President Wilson Urges Action on Power and Railroad Bills

During the last week President Wilson has made several visits to the Capitol to speed up the legislative program. In his address of Jan. 18 the President sought to effect arrangements whereby the water-power bill will be in presentable shape by March 4. He expressed the belief that the measure should be enacted into law before the close of the European war so as to permit the investment of capital in the development of water power. The principal differences of opinion are as to the methods by which power rights shall be granted and the amount the government shall be compelled to pay for return of concessions when a lease has expired.

The following day President Wilson placed special emphasis on the desirability of passing the railroad bills and again expressed his desire for quick action on the water-power bill.

Texas May Have License Law

Licensing of all highway, structural, hydraulic and sanitary engineers practising in the state is provided for in a bill to be introduced in the legislature now in session at Austin, Tex. It is proposed to create a board of inspectors to hold examinations twice a year for examining engineers for the purpose of securing state licenses. A small fee will be charged for the examination.

Third Attempt to Block Chippewa Power Scheme Fails

Court at Toronto Upholds Previous Decision—Commission Had No Right to Divert Water

The third attempt to block the Chippewa power scheme of the Canadian Hydroelectric Power Commission shared the fate of the two earlier attempts when the First Divisional Appellate Court at Toronto Jan. 12 upheld the decision of Master-in-Chambers Cameron, which set aside the writ of the Electrical Development Company of Ontario, Limited, which claimed, among other things, that the hydroelectric commission had no right to divert the waters of the Niagara or Welland River for power generating purposes. The company asked for this declaration in face of legislation by the Provincial Parliament which gave the commission power under statutes to proceed with the scheme. The company also asserted that the lieutenant-governor-in-council had no power to authorize the commission to proceed, and that covenants in the agreement between the Queen Victoria Park Commissioners and the appellants' assignors were binding upon the lieutenant-governor-in-council notwithstanding these statutes. It also asked an injunction restraining the Hydroelectric Commission from acting under the statutes passed to provide for the Chippewa work.

Court's Decision

Chief Justice Sir William Meredith, in giving the decision of the court dismissing the appeal, described the action by the Electrical Development Company as a novel attempt to obtain judgment to restrain the province from carrying out the statutes of its own legislature. As compensation was provided for under the hydroelectric commission act, the assessment of damages by the method therein set out must form the only way in which the Crown could be proceeded against.

In the written judgment of the court, Mr. Justice Hodgins points out that the argument of the appellants is that the court is entitled and bound to make a declaration which should tie the hands of the executive of the province and define exactly the limits within which that executive could act.

It is stated that the case will be appealed.

Next Week — Market Reports

Niagara Power Bill in House

Exclusive right to divert water in the United States at Niagara Falls to produce and distribute hydroelectric energy is given to the Niagara Power Commission in a bill introduced into Congress Jan. 6. The bill provides for chartering the commission as a public corporation which will be governed by a board of three commissioners, which in turn will be appointed by the President with the approval of the Senate. Of the first commissioners one will serve for two years, one for four years and one for six years; and thereafter each commissioner will serve for six years. The salary of the chairman of the commission will be $6,500 and of the other two members $6,000 per year.

The bill provides for the distribution of electric energy to municipalities and consumers convenient to the works and lines except to those who are willing to assume the cost of distribution. It is further provided that the commission shall pay into the Treasury of the United States one dollar per annual horsepower generated, that no taxes shall be levied upon the commission by any state and that the commission be allowed to contract with one or more of the concerns now generating electric energy at the Falls at a rate not exceeding $15 per annual horsepower. The bill provides a fine of not more than $5,000 for the generation of current other than that by the commission and provides that the commission may authorize such diversion for not more than 5 years at $75 per second-foot.

Road Builders Convene February 5 in Boston

The program for the seventh American good-roads congress, to be held Feb. 5 to 9, in the Mechanics Building, Boston, under the auspices of the American Road Builders' Association, includes papers on construction and maintenance of all kinds of roads as well as equipment. Traffic and its regulation and effect on design, construction and maintenance will also be discussed.

The policy and program practised by the government in road construction under new federal-aid laws will be explained by Logan Waller Page, director, U. S. Office of Public Roads and Rural Engineering. Highway engineering education is the subject on which T. R. Agg, professor of highway engineering, Iowa State College, will speak. H. E. Breed, first deputy commissioner, New York State Highway Commission, will outline the best practice in concrete road construction. Recent practice in granite-block pavements will be discussed by William H. Connell, chief of the Bureau of Highways and Street Cleaning, Philadelphia, while wood-block pavements will be the subject discussed by Ellis R. Dutton, assistant city engineer, Minneapolis. F. R. Williams, paving engineer, Cleveland, will present a paper on best practice in brick-pavement construction.

D. B. Goodsell, assistant engineer, Department of Public Works of the Borough of Manhattan, New York City, will speak on traffic census, its application to the design of roadways, selection of pavements and traffic regulation. Earth and gravel-road maintenance is the subject on which R. L. Morrison, professor of highway engineering, Agricultural and Mechanical College of Texas, will talk. In the evening of Feb. 5 the officers of the American Road Builders' Association will tender a formal reception to the exhibitors in the convention hall. The first session of the congress will be called to order at eleven o'clock Tuesday morning, Feb. 6. Governor S. W. McCall of Massachusetts and Mayor James M. Curley of Boston will welcome the delegates to the state and city respectively. Other addresses will be made by Col. William D. Sohier, chairman of the Massachusetts Highway Commission; Charles F. Weid, president of the Boston Chamber of Commerce, and George W. McNear, president of the Bay State Automobile Association.

A particularly interesting feature of the convention will be the question box. Questions to be discussed must be handed in at the registration booth not later than noon Wednesday, Feb. 7.

On Tuesday evening, at 7.30, an entertainment and smoker will be given by the Massachusetts Highway Association at Convention Hall, corner of Garrison and St. Botolph Streets. The annual dinner of the association will be held Wednesday evening at the Hotel Copley-Plaza. The reports of committees will be presented at 4.30 Thursday, Feb. 8.

Plans to End Railway Strikes

At a meeting Jan. 21 in New York City, Oscar S. Straus of the Public Service Commission announced plans for the establishment of two or more wage boards to have jurisdiction, with the commission, over labor disputes involving public utilities of the city. The suggested plan contemplates the creation of boards composed of an equal representation of employers and employees which shall endeavor to settle disputes. Failing in this, the boards shall submit the controversy to the commission, which shall have final jurisdiction. It is expected that the plan will require the men to remain at work and forbid them from being locked out.

To Organize Chinese-American Chamber of Commerce in Chicago

Steps were taken Jan. 17 to organize a Chinese-American Chamber of Commerce in Chicago with the object of promoting the development of direct trade relations between American manufacturers and China. John J. Arnold, manager of the foreign department of the First National Bank, was selected as temporary chairman. The principal speaker was Julean H. Arnold, commercial attaché of the Bureau of Foreign and Domestic Commerce, stationed at Pekin, China.

Waterworks Decision Affects Pennsylvania Boroughs

The right to construct and operate a municipal water plant was granted to Ringtown Borough, Schuylkill County, Pennsylvania, in an opinion given Jan. 9 by the Public Service Commission of Pennsylvania. The decision affects future municipal waterworks throughout the state. The opinion, by Commissioner Alcorn, points out that the commission cannot agree to extend the non-competitive principle in public-utility matters to the detriment of the public.

The Ringtown Spring Water Supply Company protested against the granting of a certificate of public convenience to the borough on the ground that it was already furnishing the inhabitants with an adequate supply of water at reasonable rates, and that there was no necessity for the borough to construct and operate waterworks for the same purpose.

The commission, however, holds that on evidence heard at the public hearing the borough had shown that the Ringtown company was not furnishing a proper water supply for domestic, commercial and fire purposes. Consequently the town should be permitted to construct and operate a municipal water plant. Commissioner Alcorn in discussing the non-competitive principle says:

"We cannot agree to extend the non-competitive principle to the hurt of the public. It is a theory that can be supported only on the ground that it is in the public interest. The probability of relief from the present water-supply agency is hopeless."

In November, 1915, the electors of Ringtown voted in favor of a bond issue for establishing the proposed waterworks and laying of mains. These bonds have been issued and plans for the work have been prepared. Most of the bonds are held by residents of the borough.

Garbage Expert Recommended for City of Cleveland

A report on the collection and disposal of garbage in Cleveland by a special committee of the city council calls for the employment of a sanitary engineer "to work out the most economical and sanitary method of collecting and disposing of Cleveland's wastes." Among other recommendations, which were made after numerous meetings with a subcommittee of the Chamber of Commerce, with city officials, I. S. Osborn, R. Winthrop Pratt and C. O. Bartlett, are: That the householders be educated in the proper method of disposing of waste and the forcing of them to comply with the law; that a regular schedule be maintained for the collection of all waste; that a standard type of receptacle be required for rubbish, and that the dumps have watchmen stationed on them at all hours and that the owners of private dumps be required to employ watchmen when filling takes any length of time.

Oregon Irrigationists Discuss Legislative Aid

The Oregon Irrigation Congress held its sixth annual meeting in Portland this month, with an attendance of about 200. A discussion of legislative problems affecting irrigationists held a prominent place in the deliberations. Strong criticism of present conditions on some projects was voiced. A set of resolutions, adopted without a dissenting voice, embodied recommendations for changes in legislation and methods of financing which it was believed would greatly improve conditions.

It was recommended that a special committee be appointed to redraft the irrigation district laws, and that suitable legislation be urged upon the state legislature. A resolution was adopted declaring the irrigation district as the best plan for the operation, maintenance and construction of irrigation projects and recommending that all irrigation projects in Oregon adopt the district plan. It was desired that there be embodied in Oregon laws that feature of the California statutes which provided for the certification of irrigation district bonds by a commission consisting of the state engineer, attorney-general and the superintendent of banks.

It was pointed out that irrigation districts should receive assistance in the form of guarantees of interest on bonds either by state or federal authorities, so that when the securities are placed on the market there would be a ready sale at prices near their real value.

L. M. Rice of Seattle pointed out that the civil engineer who helps to build up irrigation projects has more responsibility than he who runs curves and makes cost estimates. It is the province and duty of the engineer, he said, to see that everything smacking of speculation is eliminated, because no project will be a success unless it results in the actual settlement of home builders and the actual production of crops under irrigation.

Officers elected for the ensuing year were as follows: J. T. Hinkle, president; H. W. Gard, vice-president, and F. N. Wallace, secretary.

$24,850,000 Asked for Pennsylvania Roads

The budget of the Pennsylvania State Highway Department for 1917 and 1918, just made public, appropriates $24,850,000. The requested appropriation carries an item of $6,000,000 per year for state highway construction; $1,000,000 per year for highway construction within the limits of the boroughs where the state highway route is improved—the money to be allotted to the various counties on a mileage basis, final decision as to the expenditure to be left to the highway commissioner and any unexpended balance in each county to be available for use on routes outside of boroughs in the county; $1,500,000 per year for state-aid construction and maintenance, and $250,000 per year for the purchase of turnpikes and toll bridges—this money to be spent only on an even basis, the local authorities in all cases paying 50 per cent of the cost of freeing toll roads and bridges.

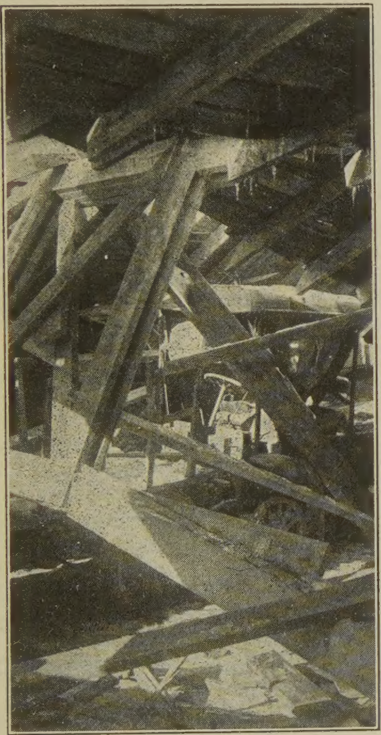
In addition to the above, $3,000,000 per year is assigned for necessary legislation to make available the automobile license fees for state highway maintenance, and $1,350,000 for a deficit in the township road bonus.

Colorado Considering New Highway Laws

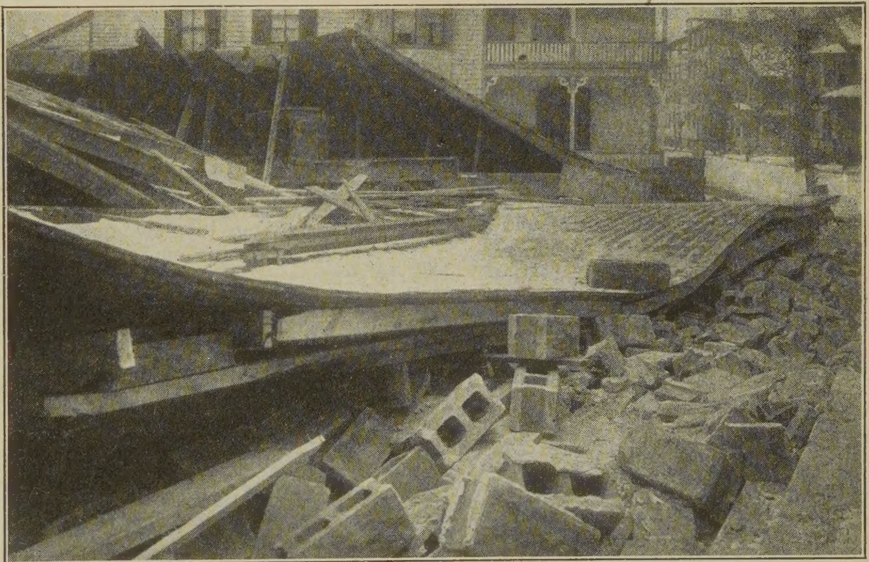
Centralization of responsibility is the main idea in the draft of a proposed highway law which the Colorado survey committee of state affairs has presented to the state legislature. The new plan has two fundamental objects—first, the development and extension of highways in accordance with a preconceived and harmonious scheme of expansion and upkeep which shall keep pace with the growth of the state, and, second, the wise and economical expenditure of funds for road work. The aim is not to destroy present forces, but to unify and concentrate them for better results.

The proposed bill creates a state highway department to be headed by five commissioners who shall appoint a state highway commissioner. The commissioner is to prepare plans and let contracts on state highways and will have the right to prescribe the qualifications of the county highway engineers and district road superintendents.

Walls and Roof of New Garage Collapse Without Warning



ON JAN. 19 the recently completed garage belonging to Charles E. Lair, of Gloversville, N. Y., collapsed suddenly. Fortunately, only one man was in the building, and he was able to escape with minor bruises. The building is 132 ft. long and varies in width from 23 ft. in the rear to 62 ft. in the front. Six wooden trusses carried a shingle roof and spanned the full distance between the side walls. These walls were built of 8-in. hollow concrete blocks 8 in. thick and 10 ft. high above the footing course. According to information, with photographs, furnished by H. J. Hanmer, the city engineer, the roof trusses rested on the 8-in. side walls without supporting pilasters.



Reject $11,000,000 Flood Prevention Plan

The flood protection plan submitted by Alvord & Burdick, contemplating the expenditure of $11,000,000 in Franklin County, Ohio, and adjacent counties, has been formally rejected by the Franklin County Court of Common Pleas at Columbus. The court considered only the financial feasibility of the plan, and did not attempt to pass on the engineering problems. The conservancy board will, therefore, be temporarily prevented from further efforts toward flood prevention.

The hearing was begun Dec. 6, 1916, at which time the legal objection was raised as to the right of the district to enlarge by taking in additional territory to protect Delaware, Chillicothe, and the farm lands between these cities, on the bottoms of the Olentangy and Scioto Rivers. The court, at a later hearing, ruled that the district could not enlarge, as to do so at a hearing before judges of Franklin County only would be illegal. It is said that this decision is going to make it practically impossible to organize conservancy districts that afford more than distinctly local protection.

Big Pipe-Line Contract Calls for Half Mile of Completed Line Per Day

What is probably the largest irrigation pipe-line contract ever let has just been awarded to Bent Brothers, of Los Angeles, specialists in this type of construction. The work consists of 125 miles of concrete pipe, mostly 16 in., to be made and laid on the lands of the N. & E. J. Allen Company in Fresno County during 1917. The system will, it is said, be as perfect in quality and detail as possible, and will include turnout boxes, weirs, standpipes, "K-T" fittings and the Hydrometric Company's "Reliance" irrigation meters. The pipe will all be precast in 2½-ft. sections. The contract requires approximately one-half-mile of completed line per day.

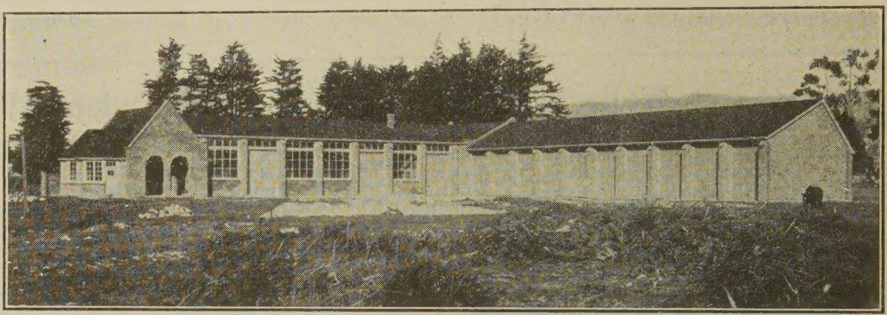
Michigan Engineers Propose License Law

At the annual meeting Jan. 16, 17 and 18 of the Michigan Engineering Society more than 180 members were present. The place of the convention was Saginaw, Mich. Licensing of civil engineers was the subject that received the greatest discussion and the society was unanimous in its adoption of a tentative bill, drafted for transmission to the state legislature now in session, by which engineers that qualify before a state board of examiners shall be "admitted to practice" in the state. The paper provides only for civil engineers in general, although it has separate clauses for land surveyors, topographic surveyors, sanitary engineers, hydraulic engineers and structural engineers. The bill, if passed, will allow the engineer to plan and erect buildings, a thing he is now prevented from doing by the architects' license law.

The following officers were elected: President, Theodore O. Williams, surveyor of Grand Rapids; vice-president, Edward D. Rich, state sanitary engineer, Lansing; treasurer, Arthur J. Decker, associate professor of sanitary engineering, University of Michigan; secretary, William W. Cox, deputy highway commissioner, Kalamazoo.

Berkeley Completes Yard for Street Department

Berkeley, Cal., has just completed the first unit of building construction at the site of the new corporation yard at Allston Way and West Street on the main line of the Atchison, Topeka & Santa Fé Railway, and will move from the old yard to the new location without delay, according to information received from Tom A. Bither, assistant superintendent of streets. The old yard, which will be abandoned and the site used for a public park, is made up of a collection of ramshackle sheds, including an old jail house and several old fire-apparatus sheds, relics of the fire-department days.


NEW CORPORATION YARD AT BERKELEY, CAL.

Complete motorization of the equipment of the Bureau of Streets will follow the moving to new quarters. The economy of motor equipment was clearly demonstrated last year, when a 3-ton auto truck replaced five two-horse teams formerly required to do the same amount of hauling. With the motorization comes the necessity for adequate repair equipment. At the old location, with almost complete lack of mechanical equipment, repairs were made with the greatest difficulty, and it was only because the motor equipment was new and the repairs were light that the work could be carried on.

At the new quarters a large machine shop has been provided, which will be equipped with modern machine tools and will be able to take care not only of repairs for the Department of Streets, but also for the fire, police and park departments.

Special architectural study was given the buildings just completed, both in grouping and design, to insure a yard which would not detract from the value of surrounding property. The site is located in the center of the city and on a main-line railroad, by means of which materials for the construction and maintenance of streets and sewers may be received direct from the cars, doing away with the intermediate hauling, which is now necessary. Further additions provide for more sheds for housing equipment to be purchased.

Signs Niagara Power Bill

President Wilson, on Jan. 19, signed the Niagara power bill authorizing the diversion of 20,000 sec.-ft. of water from the American falls for power purposes. The granting of licenses for the use of the water, and other regulations, are placed in the hands of the Secretary of War.

Consider $2,500,000 Bond Issue

Ways and means of floating a $2,500,000 bond issue to carry out improvements on both sides of the international border were discussed at a recent meeting of the directors of the Imperial Valley Irrigation District and officers of the water companies of the valley. The second report, recently made, detailed the improvements. It advocated building a new intake, channel dredging from the new structure to the Alamo channel, and the erection of many structures north of the boundary.

To Investigate Cleveland Traffic Conditions

The city council of Cleveland has directed the street railway committee to investigate questions relating to a downtown subway terminal for street cars, with special reference to location of terminals, whether the city can construct subway terminals, and whether a private company should be allowed to build and operate such terminals. The report will be presented as soon as possible.

Calls Drainage of Everglades Florida's Chief Problem

Drainage of the Florida Everglades was characterized as the state's chief problem by Governor Sidney J. Catts in his recent inaugural address. The first step in that direction, he said, would be an awakening of the people to the greatness of the project, people living in other sections of the state not being properly in sympathy with it. After that, he said, it would be necessary to float $3,000,000 worth of bonds, and then an equivalent amount, but the result, he thought, would be "the richest land on earth."

Engineering Society Activities

Florida Engineering Society will hold its first annual meeting Feb. 2 and 3 in Tampa. The meeting will be held in the council chamber, City Hall, and the headquarters will be at the Hillsborough Hotel.

American Institute of Consulting Engineers, at its annual meeting Jan. 15, elected the following members to the council: Gardner S. Williams, A. M. Hunt, Lewis B. Stillwell and William J. Wilgus.

Nebraska Association of Members of the American Society of Civil Engineers was organized Jan. 5 at Lincoln. The following officers were elected: President, Frank C. Darrow, Lincoln, engineer maintenance-of-way of the Chicago, Burlington & Quincy Railroad; vice-presidents, Adna Dobson, city engineer of Lincoln, and George L. Campen, Omaha, consulting engineer; secretary and treasurer, Homer V. Knouse, Omaha, constructing engineer, Metropolitan Water District of Omaha. The Legislative Advisory Committee is the name of a body formed at the first meeting which has for its purpose the advising of the State legislators on engineering subjects. William Grant, of Lincoln, was made chairman of the committee. The next meeting of the association will be held Feb. 3 at Lincoln.

American Association of Engineers, board of directors, has appointed N. M. Stineman, building engineer, Chicago, Milwaukee & St. Paul Railway, to fill the directorship left vacant by the resignation of T. B. Lambert. The Gary chapter reports the election Jan. 12 of its temporary president and secretary, G. C. Dooge and W. H. Sallwasser, respectively, as permanent officers for the ensuing year.

Iowa Engineering Society will hold its annual meeting Feb. 21-23 at Iowa State College, Ames.

Minnesota Surveyors' and Engineers' Society will hold its annual meeting Feb. 7-9 at the Hotel Radisson, Minneapolis.

Indiana Sanitary and Water Supply Association's annual meeting will be held Feb. 14 and 15 at the Claypool Hotel, Indianapolis.

Ohio Engineering Society will hold its annual meeting in Columbus at the State University Jan. 31 and Feb. 1 and 2.

Western Society of Engineers was addressed Jan. 15 by T. Chalkley Hatton, chief engineer, Milwaukee Sewerage Commission, on "Modern Sewage-Disposal Methods." He was followed by Prof. Edward Bartow, director of the Illinois State Water Survey, who detailed his experiences with activated sludge at Urbana. The hydraulic, sanitary and municipal section, under whose auspices the meeting was held, elected the following officers for the ensuing year: Chairman, Dabney H. Maury; vice-chairman, H. E. Hudson; directors, W. T. Barnes and Murray Blanchard. These officers, with W. W. DeBerard, the retiring chairman, form the executive committee of the section.

Engineering Society of Wisconsin will hold its annual convention Feb. 15 and 16 at Madison. Among those on the preliminary program are Prof. J. G. D. Mack, Fred G. Simmons, Prof. C. I. Corp, N. W. Withey, George H. Randall, F. A. Vaughn, W. T. Blackburn, Prof. George R. Bascom, H. E. Smith, H. V. Tennant and Prof. W. S. Kinne.

Engineering Society of York, Pa., at its recent annual meeting elected the following officers to serve for 1917: President, George A. Jessop; vice-president, Chauncey D. Bond; secretary, M. Haller Frey, Polack Building; treasurer, Harold A. Russel; directors, W. W. Birnstock, Griffith S. Amies, Harry W. Motter and officers.

Kansas Engineering Society held its annual meeting Jan. 16 and 17 in Topeka. The relation of the society to electrical, mechanical and railroad engineers and to architects was discussed in four separate papers. To publicity and the question of how to enlarge the membership were devoted two papers and a committee report. Road and highway bridge problems also were treated.

Iowa State Drainage Association will meet Feb. 20 and 21 in Fort Dodge.

What Engineers and Contractors Are Doing

F. J. Stimson, superintendent of the Zanesville division of the Pennsylvania Lines West of Pittsburgh, has been transferred to the superintendency of the Richmond division. Mr. Stimson entered the service of the Grand Rapids & Indiana Railway in November, 1888, as clerk in the office of the claim and timber agent. He went into the field as rodman in the following year and continued in that position on various surveys and construction work until June, 1890, when he engaged in railroad surveys, maintenance of way and tunnel construction work in the southwest. In March, 1893, he returned to the service of the Grand Rapids & Indiana Railway as assistant roadmaster and was promoted to division engineer of the northern division in January, 1904. In July, 1915, Mr. Stimson was appointed superintendent of the Zanesville division.

W. A. Cowan, formerly division engineer of the Ontario division of the Transcontinental Railway, has been appointed acting general superintendent, owing to the temporary absence of F. P. Brady.

Harold A. Rands, of Oregon City, Ore., recently accepted a position with the Alaskan Engineering Commission and sailed for Fairbanks, Alaska. Mr. Rands was chairman of the Oregon City Board of Water Commissioners, and was engineer in charge of construction of the South Fork pipe line which brings mountain water to Oregon City. He described this work in the Engineering Record of Dec. 9, 1916, page 700.

W. C. Whitnall has been appointed city engineer and water superintendent of Auburn, Wash.

D. M. Mawhinney, formerly with the Winnipeg, Selkirk & Lake Winnipeg Railway, has been appointed engineer of the municipality of Rockwood, Man.

Albert T. Canfield has resigned from the employ of the Kansas City Stock Yards Company to go with the engineering department of the Union Pacific Railroad at Omaha.

Gulick-Henderson Company, consulting and inspecting engineers, announce the removal and consolidation of their general offices to 13-21 Park Row, New York City.

Charles E. Eaton, consulting engineer, of Watertown, N. Y., has removed his office to the New Sherman Building. Mr. Eaton will continue to specialize in the designing and planning of paper, pulp and fiber mills, and hydroelectric and steam power developments.

Higgins & Greenwood, engineers and architects, of New York City, have removed their offices to the City Investing Building.

J. R. Morrison has opened offices at the White Building, Seattle, and will engage in general engineering practice. Mr. Morrison was formerly connected with the engineering department of King County, Washington.

Lorenz A. Dithmer, of Hailey, Idaho, has been elected county engineer of Blaine County.

C. E. Crownover, manager of storage construction for the Yakima irrigation project, U. S. Reclamation Service, recently removed his office to North Yakima, Wash., to organize his force for the construction of the $2,000,000 irrigation dam at McAllister Meadows, 40 miles from Naches City. This year's work will be devoted to the construction of necessary buildings and of a 1600-ft. outlet tunnel.

R. L. Cavanaugh has been reappointed city engineer of North Bend, Ore.

Fred C. Cramer, of Kelso, Wash., has succeeded R. C. Westwick as county engineer of Cowlitz County. Mr. Cramer will be located at Kalama, the county seat.

Frank D. Gore, of Port Orchard, Wash., has become county engineer of Kitsap County, succeeding S. H. Berry.

Charles L. Kinney has succeeded Albert A. Reith as county engineer of Elkhart County, Indiana, with office at Goshen. During the last twenty years Mr. Kinney served as city engineer of Elkhart and Goshen, and also as bridge engineer for the Toledo & Western Railroad. Mr. Reith has formed the Reith Construction Company, with headquarters at Goshen. The new company will operate in all lines of construction throughout the state.

J. R. BAYLIS has been appointed bacteriologist of the Montebello filters, Baltimore Water Department. Mr. Baylis, who left a position as manager of the Jackson (Miss.) waterworks, where he had charge of construction of the filter plant, has had a broad experience in municipal work throughout the South. Since 1912 he has been connected with the firm of Kirkpatrick, Culley, McCorkle & Baylis, consulting engineers.

JESSE K. GIESEY has been made a member of the firm of Fuller & McClintock, consulting engineers of New York City. Mr. Giesey was graduated from Rensselaer Polytechnic Institute in 1904. He was a member of the staff of Hering & Fuller from 1904 to 1911 and assistant engineer with Hering & Gregory from 1911 to 1914. For the last two and one-half years he has been in charge of the construction of the outfall sewer, pumping station and sewage-treatment works at York, Pa.

FRED E. JOEKEL, recently appointed deck officer of the U. S. S. Hydrographer, is engaged in making a resurvey of the Gulf Coast from the Mississippi delta to Mobile Bay. Previous to this appointment Mr. Joekel held the position of field and office draftsman with the Texas Power & Light Company, of Dallas, Tex.

R. C. NAGLE has resigned his position with Albert Kahn and will go to Japan for the Trussed Concrete Steel Company.

T. C. DESMOND & COMPANY, INC., engineers and contractors, 110 West 34th St., New York city, announce the incorporation of their business for the purpose of undertaking engineering and construction contracts of all descriptions. Thomas C. Desmond has been elected president of the company.

EDWARD C. SHERMAN, consulting engineer, of Boston, will on Feb. 1 take up duties as designing engineer, Bureau of Yards and Docks, Navy Department, Washington. Mr. Sherman is a native of Kingston, Mass., and was graduated from the Massachusetts Institute of Technology in 1898. After two months as transitman with the Massachusetts Topographical Survey, he spent four months with the U. S. Board of Engineers on Deep Waterways as rodman. That was followed by his employment as draftsman in the office of the city engineer of Boston. From 1899 to 1902 he was engaged on work for the Cambridge Bridge Commission, being promoted to assistant engineer in the latter year. From 1903 to 1909 Mr. Sherman was assistant and later division engineer with the Charles River Basin Commission, and from 1909 to 1911 he was designing engineer for the Isthmian Canal Commission. Returning to Boston in 1911, Mr. Sherman engaged in private practice. He was retained as consulting engineer for the Merrimack Valley Waterways Board. In 1915 he formed a partnership with L. K. Rourke under the firm name of Rourke & Sherman. Mr. Sherman has been editor of the *Journal* of the Boston Society of Civil Engineers since its inception in 1914.

COL. THOMAS H. REES, Corps of Engineers, U. S. A., who has been stationed in San Francisco since 1911, has been assigned to the third regiment of engineers in the Philippines and will leave San Francisco on Feb. 5. Colonel Rees has been serving as department engineer of the western department and district engineer in charge of the first and second San Francisco engineering districts. He has also been chairman of the California Debris Commission. He will be succeeded by Col. Edward Burr, Corps of Engineers, U. S. A., who is now department and district engineer at Manila.

GEORGE B. DUBOIS, formerly with the International Pulp Company as efficiency engineer, has taken a position with the Compania de Minerales y Metales, S. A. He will be employed as location engineer on some proposed lines in Mexico.

E. B. YOUNGMAN has resigned as city engineer of Hazleton, Pa., to become chief of the coal and fuel department of the Harwood Electric Company.

BECKMAN AND LINDEN ENGINEERING CORPORATION has been incorporated with offices in the Balboa Building, San Francisco. The partners are J. W. Beckman, formerly with the Great Western Power Company, and H. E. Linden, of the Southern Sierras Power Company. The firm will carry on consulting and development work in civil, electrical, metallurgical and chemical engineering. Its activities will embrace investigations of the natural resources adjacent to existing or prospective power developments with a view to developing new industrial uses of power. Investigation of hydroelectric developments, complete designing and construction of power projects are also included in the firm's work. The company is also prepared to finance prospective developments. Mr. Beckman, following a number of years' experience in metallurgical and chemical industrial work in Europe, was successively associated with the research laboratories of the General Electric Comjany, the American Cyanimide Company, the Aluminum Company of America, the Great Western Electro-Chemical Company, and the Great Western Power Company. By the last named company he is retained in a consulting capacity. Mr. Linden's activities in electrical engineering and hydroelectric development embrace a term of 12 years with the Sprague Electric Company, the Stone & Webster Engineering Corporation, and recently with the Southern Sierras Power Company.

Obituary Notes

GEORGE A. H. MOULD, civil engineer, well known in the structural field, died last Sunday at his home in New York City. He was born in 1864 at Kingston, Jamaica, West Indies. His first engineering work was with the Jamaica Department of Public Works, with which he became associated in 1879. Mr. Mould went to New York City in 1900 to enter the employ of Milliken Brothers. He later had charge for that firm of much important construction in Havana and in South Africa. His most recent work was for C. T. Wills, general contractor, of New York City.

MICHAEL RABBITT, president and founder of the M. Rabbitt & Sons Company, Toledo, died Jan. 5.

WILLIAM H. HEDGES, a pioneer Chicagoan and for 36 years an employee of the city, died Jan. 15. He was plainsman, scout, railroad constructor, city engineer and adopted member of an Indian tribe. He retired in April, 1915, after 25 years of continuous service as grade superintendent in the city engineer's office. In 1856 Mr. Hedges went to Canada to make a survey for the Great Western Railway. After that work was completed he went to Iowa as chief engineer for the Dubuque & Anamosa Railway, and while there had charge of the work of draining swamp lands in the southwestern part of the state. He took part in the gold rush across the plains to Pike's Peak, but returned shortly to Chicago, where he made the original survey of the harbor for the government. In 1865 he entered the employ of the city and made the original survey with the view to widening the river. At the time of the great fire, when all public records of city surveys were destroyed except the private set of notes that Mr. Hedges had saved, he turned his notes over to the city, scorning the money offered him, declaring that in time of stress his services to the public could not be measured in dollars. In 1879 he again heard the call of the West and went to the Dakotas as scout and topographical engineer for the Chicago & North Western Railway with Mr. Blunt, a close friend, as chief engineer. He staked out a claim among the hostile Sioux and settled 80 miles from neighbors or railroads. Upon his return to Chicago he resumed his old position in the engineering department. Among the things which he accomplished for the city was the establishment of a uniform city datum. He made the preliminary survey for Lincoln Park and had charge of the construction of many sewers.